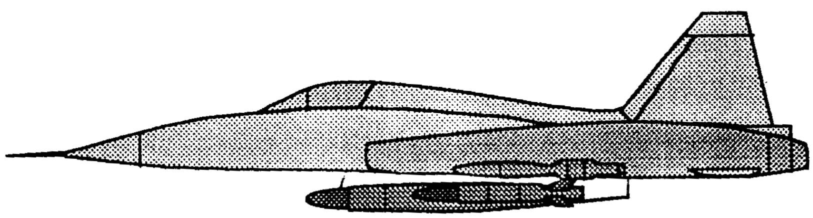
DCN 1007

# Annex 3

# Air Force BRAC '95 Analysis of T&E Infrastructure

## Completion of T&E JCSG Analysis Plan

## Air Vehicles T&E Analysis



February 1995

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# Annex 3
# of the
# Air Force BRAC '95 Analysis
# of
# T&E Infrastructure

**Completion of T&E JCSG Analysis Plan**

**Air Vehicles T&E Analysis**

February 1995

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# Purpose

- Complete T&E JCSG Analysis of AV T&E Functional Area

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The purpose of this Annex is to document the completion of the T&E Joint Cross Service Group (JCSG) Analysis Plan for Air Vehicles (fixed and rotary wing) by the Air Force T&E Team. This analysis picks up where the T&E JCSG left off by addressing opportunities for realignment/consolidation among "core" T&E activities since the jointly developed T&E JCSG alternatives addressed only "non-core" T&E activities.

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## Outline

- AV T&E Baseline
- Optimization Model Outputs
- Capability/Capacity Analysis
- Alternatives
  - JCSG (Non-Core)
  - Other (Core)
- Summary

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The Air Vehicle T&E baseline and results of the optimization model runs which were conducted by the T&E JCSG are summarized. An Air Force assessment of capability and capacity matches of all Air Vehicle test facilities with potential for consolidation is presented. (The T&E JCSG restricted the T&E Joint Cross Service Working Group (JCSWG) consideration to realignment of facilities at non-core T&E activities.) The T&E realignment alternatives developed and approved by the T&E JCSG for non-core T&E activities are summarized, followed by other potential realignment opportunities for core T&E activities developed by the AF.

**AV T&E Baseline**

## DoD Activities and Functional Value

| Department | Activity | Functional Value | Facilities | MRTFB |
|---|---|---|---|---|
| AF | AFFTC, Edwards AFB | 85 | 7 | Yes |
| AF | AFDTC, Eglin AFB | 58 | 2 | Yes |
| AF | 476 WEG, Tyndall AFB | 47 | 1 | No |
| AF | UTTR, Hill AFB | 46 | 1 | Yes |
| AF | AFDTC, Holloman | 33 | 2 | Yes |
| AF | AEDC, Arnold | 18 | 2 | Yes |
| | **Total Air Force** | | **15** | |
| Navy | NAWC, Pax River | 81 | 18 | Yes |
| Navy | NAWC, Pt Mugu | 69 | 2 | Yes |
| Navy | NAWC, China Lake | 43 | 2 | Yes |
| Navy | NSWC, Dahlgren | 25 | 1 | No |
| Navy | NAWC, Indianapolis | 19 | 3 | No |
| Navy | NAWC, Warminster | 14 | 1 | No |
| | **Total Navy** | | **27** | |
| Army | AQTD, EAFB | 46 | 1 | No |
| Army | EPG, Ft Huachuca | 44 | 4 | Yes |
| Army | YPG, Yuma | 35 | 3 | Yes |
| Army | ATTC, Ft Rucker | 34 | 1 | No |
| | **Total Army** | | **9** | |
| **DoD Total** | | | **51** | |

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The Air Vehicle T&E (AV T&E) functional area baseline consisted of 16 activities that reported AV T&E workload in one or more test facilities (threshold for consideration was workload greater than 5% AV T&E and 100 test hours). Ten of the 16 activities are designated major range and test facility bases (MRTFB). A total of 51 facilities was analyzed by the T&E JCSWG, using certified data and established scoring criteria, resulting in the activity functional value rankings, by service, shown in the table. AFFTC Edwards and NAWC Pax River were ranked #1 and #2 respectively, reflecting the concentration of air vehicle test facilities (25 of 51) at the two major DoD air vehicle test centers. The remaining 14 activities generally have just one or two facilities each. For many of these activities, AV T&E represents only a small part of facility workload. Therefore realigning only AV T&E workload from these activities would result in limited reduction of T&E infrastructure.

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## AV T&E Baseline
### DoD T&E Facilities

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| AFFTC, Edwards | 85 | 1 | 2 | 2 | | 1 | 1 |
| NAWC, Pax River | 81 | | 9 | 1 | 6 | 1 | 1 |
| NAWC, Pt Mugu | 69 | | 1 | | | | 1 |
| AFDTC, Eglin | 58 | | 2 | | | | |
| 476 WEG, Tyndall | 47 | | | | 1 | | |
| UTTR, Hill | 46 | | | | | | 1 |
| AQTD, Edwards | 46 | | | | | | 1 |
| EPG, Ft Huachuca | 44 | | 3 | | | | 1 |
| NAWC, China Lake | 43 | | 2 | | | | |
| YPG, Yuma | 35 | | 1 | | | | 2 |
| ATTC, Ft Rucker | 34 | | | | | | 1 |
| AFDTC, Holloman | 33 | | 2 | | | | |
| NSWC, Dahlgren | 25 | | 1 | | | | |
| NAWC, Indianapolis | 19 | | 1 | 2 | | | |
| AEDC, Arnold | 18 | | 2 | | | | |
| NAWC, Warminster | 14 | 1 | | | | | |
| **Total** | | 2 | 26 | 5 | 7 | 2 | 9 |

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Facilities were grouped into six Test Facility Categories (TFC) as defined in the T&E JCSG data call. As part of the data certification process each activity was required to categorize its own test facilities, resulting in some inconsistencies in categorizing similar facilities. This table illustrates the predominance of test facilities in the measurement and open air range test facility categories. AFFTC Edwards and NAWC Pax River can satisfy most AV T&E requirements in the six test facility categories.

## AV T&E Baseline
### DoD Capacity (Test Hours)

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| AFFTC, Edwards | 85 | 1987 | 3392 | 118999 | | 1968 | 11998 |
| NAWC, Pax River | 81 | | 40491 | 4880 | 163371 | 14119 | 12246 |
| NAWC, Pt Mugu | 69 | | 575 | | | | 4787 |
| AFDTC, Eglin | 58 | | 7061 | | | | |
| 476 WEG, Tyndall | 47 | | | | 2683 | | |
| UTTR, Hill | 46 | | | | | | 3380 |
| AQTD, Edwards | 46 | | | | | | 2626 |
| EPG, Ft Huachuca | 44 | | 2858 | | | | 646 |
| NAWC, China Lake | 43 | | 3295 | | | | |
| YPG, Yuma | 35 | | 297 | | | | 6028 |
| ATTC, Ft Rucker | 34 | | | | | | 12050 |
| AFDTC, Holloman | 33 | | 42814 | | | | |
| NSWC, Dahlgren | 25 | | 3347 | | | | |
| NAWC, Indianapolis | 19 | | 23218 | 14288 | | | |
| AEDC, Arnold | 18 | | 4815 | | | | |
| NAWC, Warminster | 14 | 1393 | | | | | |

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Certified data were used by the T&E JCSWG to calculate the capacity and projected workload for each of the 51 test facilities in accordance with the T&E JCSG Analysis Plan. The table shows the DoD Air Vehicle T&E capacity available at each activity, arranged in order of functional value, for each test facility category. Functional value, capacity and projected workload were basic inputs to the optimization model used in the T&E Joint Cross Service Group analysis. Numerical capacities represent aggregation of all test facilities at an activity within each test facility category.

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## AV T&E Baseline
### DoD Workload (Test Hours)

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| AFFTC, Edwards | 85 | 270 | 2360 | 69485 | | 121 | 7583 |
| NAWC, Pax River | 81 | | 27288 | 2275 | 112239 | 9553 | 7661 |
| NAWC, Pt Mugu | 69 | | 327 | | | | 1679 |
| AFDTC, Eglin | 58 | | 4911 | | | | |
| 476 WEG, Tyndall | 47 | | | | 1932 | | |
| UTTR, Hill | 46 | | | | | | 1940 |
| AQTD, Edwards | 46 | | | | | | 1258 |
| EPG, Ft Huachuca | 44 | | 398 | | | | 277 |
| NAWC, China Lake | 43 | | 1830 | | | | |
| YPG, Yuma | 35 | | 131 | | | | 3404 |
| ATTC, Ft Rucker | 34 | | | | | | 3776 |
| AFDTC, Holloman | 33 | | 27530 | | | | |
| NSWC, Dahlgren | 25 | | 943 | | | | |
| NAWC, Indianapolis | 19 | | 16324 | 10046 | | | |
| AEDC, Arnold | 18 | | 2569 | | | | |
| NAWC, Warminster | 14 | 1003 | | | | | |

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The table shows the DoD Air Vehicle T&E projected workload in each test facility category at each activity. This "starting point" for the optimization model indicates how the workload would be distributed before any realignments. A subsequent table will show how the optimization model consolidated this workload.

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**AV T&E Baseline**

## DoD Workload and Capacity Summary

| Test Facility Category | Facilities | Capacity (Test Hours) | Projected Workload (Test Hours) | Excess Capacity (Test Hours) |
|---|---|---|---|---|
| Digital Models and Simulations | 2 | 3380 | 1273 | 2107 |
| MF - Avionics | 5 | 6155 | 2631 | 3524 |
| MF - Communications | 4 | 2091 | 1136 | 955 |
| MF - Environmental | 7 | 35314 | 23158 | 12156 |
| MF - Electromagnetic | 1 | 3347 | 943 | 2404 |
| MF - Guidance/Signature | 5 | 47487 | 30719 | 16768 |
| MF - Propulsion | 3 | 37155 | 25854 | 11301 |
| MF - Sled Tracks | 1 | 614 | 170 | 444 |
| Integration Laboratory | 5 | 138167 | 81806 | 56361 |
| Hardware-In-The-Loop | 7 | 166054 | 114171 | 51883 |
| Installed System Test | 2 | 16087 | 9674 | 6413 |
| Open-Air-Range | 9 | 53761 | 27578 | 26183 |
| Total | 51 | 509612 | 319113 | **190499** |

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The total DoD Air Vehicle T&E baseline capacity and workload are shown in the table for each test facility category. The 26 test facilities in the measurement category comprised a diverse group of technical capabilities. To facilitate the realignment analysis using computer-based optimal theory, the AV T&E JCSWG further divided the measurement facility category into seven subcategories to reduce the number of potential technical capability mismatches in the consolidated workload. The 51 Air Vehicle T&E facilities contain 190,499 test hours of DoD excess capacity (37%).

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**AV T&E Baseline**

## DoD Workload & Capacity Summary

**(Test Hours/Year)**

| Department | Activities | Facilities | Capacity | Projected Workload | Excess Capacity | % of Excess Capacity |
|---|---|---|---|---|---|---|
| Air Force | 6 | 15 | 199,097 | 118,701 | 80,396 | 42% |
| Navy | 6 | 27 | 286,010 | 191,168 | 94,842 | 50% |
| Army | 4 | 9 | 24,505 | 9,244 | 15,261 | 8% |
| Total | **16** | **51** | 509,612 | 319,113 | **190,499** | 100% |

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The table summarizes the DoD Air Vehicle T&E projected workload, capacity and excess capacity by service. In the subsequent analysis it will appear that the reduction of excess capacity is relatively modest. Part of that perception is due to the fact that much of the numerical excess capacity comes from a few test facilities that cannot be consolidated. For example, of the eighty thousand hours of excess capacity within fifteen Air Force test facilities, almost sixty thousand hours (75%) are in two non-duplicate facilities. Approximately 63% of the total DoD Air Vehicle T&E excess capacity is from six non-duplicate facilities. Except for open air ranges, there is not a lot of opportunity for significant consolidation of the existing air vehicle T&E infrastructure.

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# Outline

- AV T&E Baseline
- Optimization Model Outputs
- Capability/Capacity Analysis
- Alternatives
  - JCSG (Non-Core)
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## Optimization Model Outputs
### AV T&E Realignment

| Activity | MAXFV (W=0) | MAXFV (W=95) | MAXFV (minsites) | MINXCAP (W=100) | MAXSFV (nsite) | MINNMV (W=95) | Summary |
|---|---|---|---|---|---|---|---|
| | Objective Functions | | | | | | |
| AFFTC, Edwards AFB | 1 | 1 | 1 | 1 | 1 | 1 | Retain |
| NAWC, Pax River | 1 | 1 | 1 | 1 | 1 | 1 | Retain |
| NAWC, Pt Magu | 1 | 1 | 1 | 0 | 1 | 1 | Retain |
| AFDTC, Eglin AFB | 1 | 0 | 0 | 0 | 0 | 0 | Realign |
| 476 WEG, Tyndall | 0 | 0 | 0 | 0 | 0 | 0 | Realign |
| UTTR, Hill AFB | 0 | 0 | 0 | 1 | 0 | 0 | Realign |
| AQTD, Edwards | 0 | 0 | 0 | 0 | 0 | 0 | Realign |
| EPG, Ft Huachuca | 1 | 0 | 0 | 0 | 0 | 0 | Realign |
| NAWC, China Lake | 1 | 0 | 0 | 0 | 0 | 0 | Realign |
| YPG, Yuma | 1 | 0 | 0 | 0 | 0 | 0 | Realign |
| ATTC, Ft Rucker | 0 | 0 | 0 | 0 | 0 | 0 | Realign |
| AFDTC, Holloman | 1 | 1 | 1 | 1 | 1 | 1 | Retain |
| NSWC, Dahlgren | 1 | 1 | 1 | 1 | 1 | 1 | Retain |
| NAWC, Indianapolis | 1 | 1 | 1 | 1 | 1 | 1 | Retain |
| AEDC, Arnold | 0 | 0 | 0 | 0 | 0 | 0 | Realign |
| NAWC, Warminster | 0 | 0 | 0 | 0 | 0 | 0 | Realign |

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The purpose of the optimization model was to show where DoD workload could be consolidated among the services using an "unbiased" and objective method. The model was run by the T&E JCSG six times using slightly different objective functions which sought to maximize functional value or maximize functional value times workload or minimize the excess capacity or minimize the number of activities assigned workload. The table shows which activities retained workload (denoted by a "1") and which activities had all workload transferred (denoted by a "0") for the "official" model runs. With few exceptions the same six activities remained "open" for all runs while the other activities were "realigned" as indicated in the summary column. The activities at Holloman, Dahlgren and Indianapolis were always retained due to individual measurement facility workloads that exceeded the combined capacities of all other facilities in a measurement facility subcategory.

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## Optimization Model Outputs
## Air Vehicles T&E Workload (Test Hours)
### (MAXFV (MINSITES))

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| **AFFTC, Edwards** | **85** | 1273 | 3392 | **81806** | | **1968** | **11998** |
| **NAWC, Pax River** | **81** | | 30703 | **0** | **114171** | 7706 | **12246** |
| **NAWC, Pt Mugu** | **69** | | 575 | | | | 3334 |
| **AFDTC, Eglin** | **58** | | **0** | | | | |
| 476 WEG, Tyndall | 47 | | | | 0 | | |
| **UTTR, Hill** | **46** | | | | | | **0** |
| AQTD, Edwards | 46 | | | | | | 0 |
| **EPG, Ft Huachuca** | **44** | | 0 | | | | **0** |
| **NAWC, China Lake** | **43** | | **0** | | | | |
| **YPG, Yuma** | **35** | | **0** | | | | **0** |
| ATTC, Ft Rucker | 34 | | | | | | 0 |
| **AFDTC, Holloman** | **33** | | 27985 | | | | |
| NSWC, Dahlgren | 25 | | 943 | | | | |
| NAWC, Indianapolis | 19 | | 21013 | 0 | | | |
| **AEDC, Arnold** | **18** | | **0** | | | | |
| NAWC, Warminster | 14 | 0 | | | | | |

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The workload distribution resulting from the T&E JCSG optimization model run for MAXFV(minsites) is shown in the table. For this run the optimization algorithm consolidated workload at activities with the highest functional value and available capacity within each test facility category. However, the optimization algorithm had no knowledge of potential mismatches in technical capabilities when consolidating workload. Thus, the workload consolidation shown is the "best" that could be achieved if there were no mismatches. Functional area expertise and judgment were required to determine if the indicated consolidations could realistically be accomplished.

The T&E JCSG designated the ten MRTFB activities as "core" and constrained formulation of the realignment alternatives by not allowing transfer of work between "core" activities. The boldface entries indicate that the majority of test facilities were "core".

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Capability/Capacity Analysis for Air Vehicles T&E

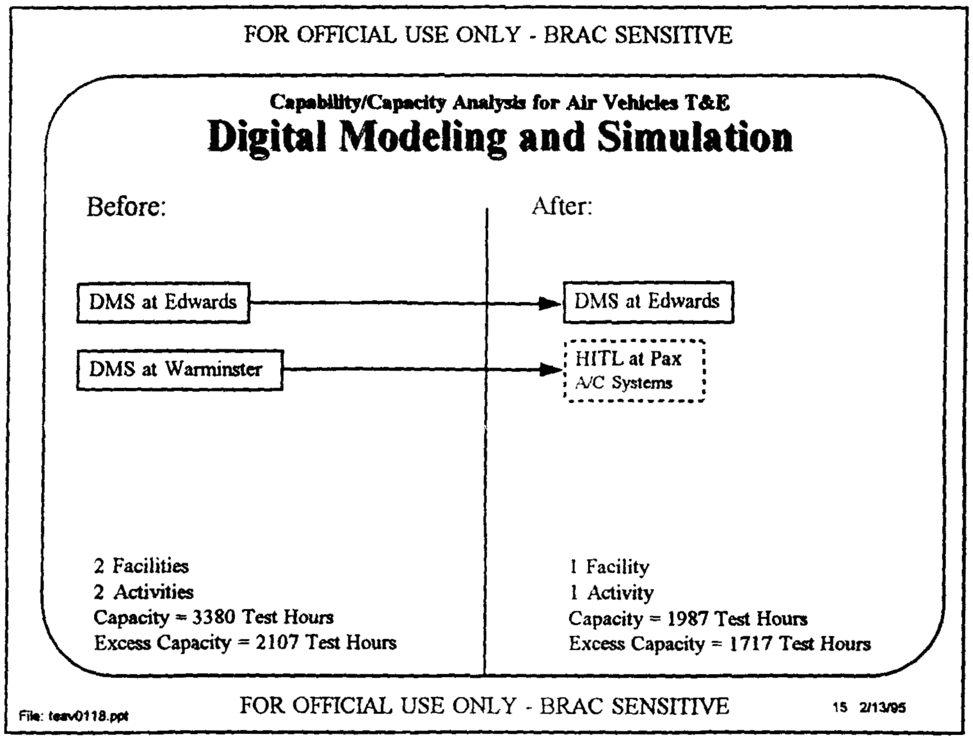
## Approach

- Use Optimization Model Output as Basis for Further Analysis at the Facility Level
- Identify Capability / Capacity Mismatches and Opportunities to Realign at the Facility Level
  - Based on Model Outputs and Certified Data
- Identify Additional Opportunities to Realign Across Test Facility Categories and Functional Areas
  - Realign to Minimize Number of Activities and Facilities
- Adjust Model Output and Configuration Baseline
  - Move Workload to Activity with Highest FV and Required Capability (Unless Compelling Reason to Do Otherwise)
  - Preserve Test Process and Unique Capabilities



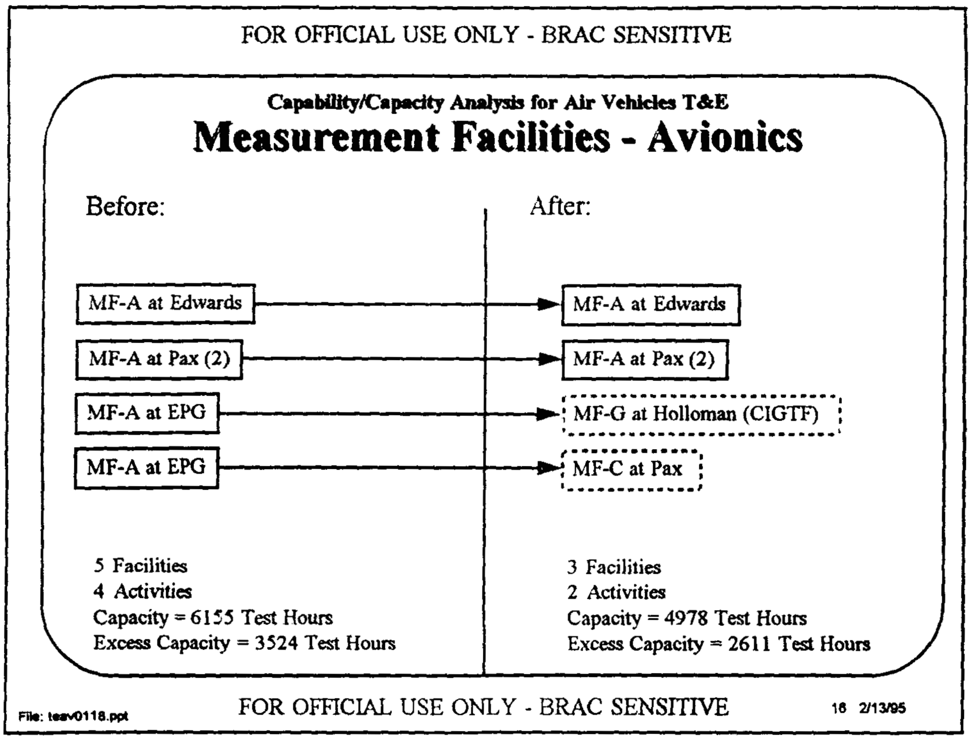
The optimization model suggested which facilities had sufficient capacity to "optimally" consolidate AV T&E workload within a test facility category. However the model could not determine if the consolidated facilities retained all the technical capabilities to accomplish the consolidated workload. Therefore, expert judgment was applied, considering facility technical descriptions provided in the certified data, to assess the likelihood that realigned facilities constituted a technically feasible consolidation. In those cases where a mismatch was indicated, the consolidated workload was manually "adjusted" to retain workload in the mismatched facility. In addition, facility technical descriptions were compared across test facility categories to see if the remaining AV T&E workload could be further consolidated. Several such matches occurred, both as a result of inconsistencies in facility categorization and because many facilities had multiple capabilities. Workload was "adjusted" to reflect a move to the activity with the highest Functional Value with sufficient capacity.

While the "adjusted" workload realignments resulting from this analysis may be technically feasible, many may not be practical from the standpoint of cost effectiveness and/or potential impacts (not analyzed) on other workload conducted at the realigned facilities.




The next twelve charts summarize the results of the capability/capacity analysis in a graphical "before-after" presentation. Potential realignments within each test facility category are indicated by the solid boxes. The phantom (dashed) boxes indicate potential realignments to or from another test facility category.

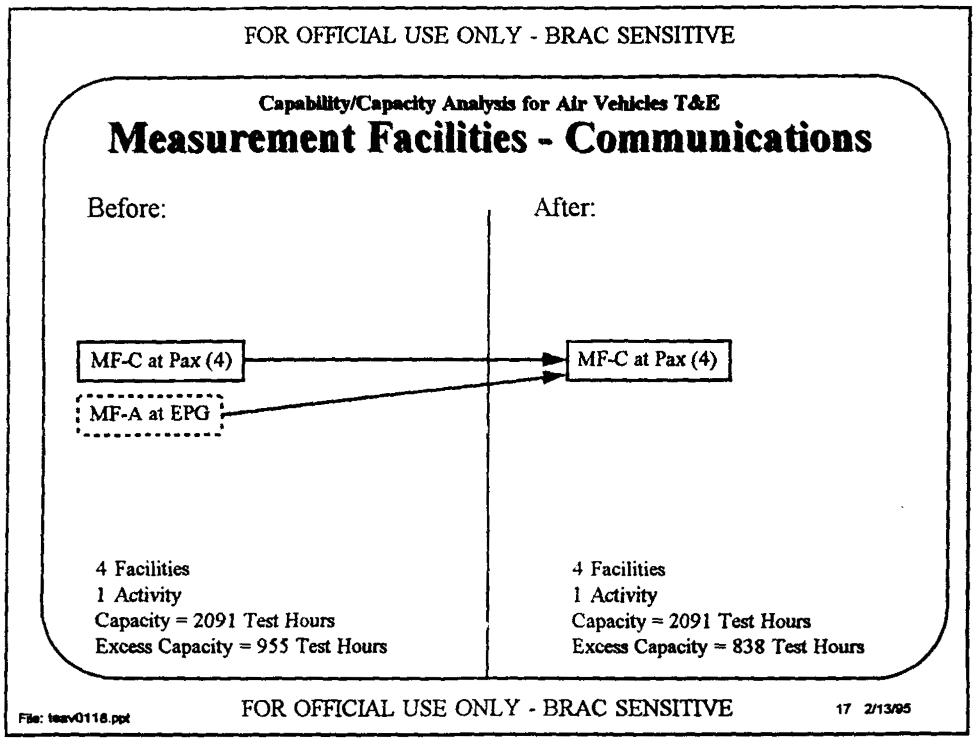
The T&E Mission Simulator (Edwards) directly supports flight test programs so that this facility is required to be co-located where the open air range testing it supports is conducted. The simulation facility at Warminster is unique because of the centrifuge used to test air crew support systems. The Air Crew Support Systems Test facility (Pax River) conducts similar test activities and would be the logical choice to realign this work if NAWC Warminster was to be closed. The centrifuge equipment would be required to be moved to retain the technical capabilities.



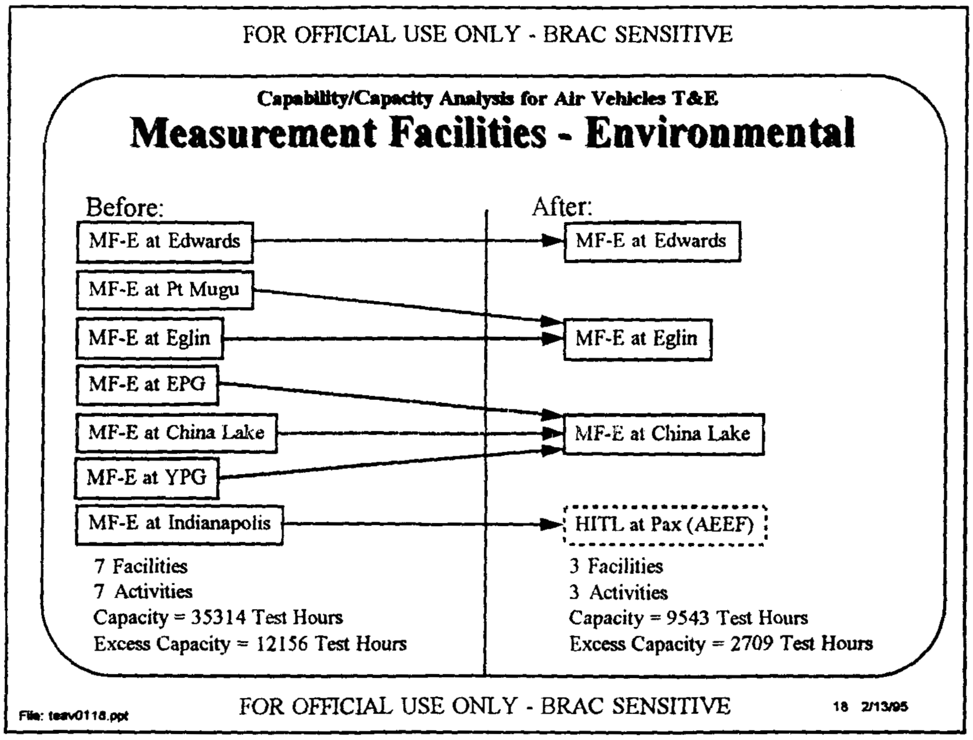

None of the facilities within this subcategory was compatible, partly because this category was used as a catch-all for some facilities which did not fit elsewhere.

The EW/Avionics Flight Test facility (Pax River) measures dynamic RCS of flight test aircraft and the Aircraft T&E Facility (Pax River) is used in ground testing of both installed and uninstalled aircraft electrical and mechanical subsystems. The Human Factors Lab (Edwards) supports anthropometric measurements for human factors flight test programs.

The Avionics/GPS Test facility (EPG) conducts GPS testing which could be consolidated at the CIGTF facility at Holloman AFB; however, only 10% of the workload is AV T&E. The Range Operations facility (EPG) is used for ground-based antenna measurements and there is sufficient capacity at the GRATF facility (Pax River) for this workload; however, this facility is utilized only 21% for AV T&E. While the AV T&E projected workload at the two EPG facilities could be accommodated at other activities, the workload is only slightly more than the facility consideration threshold of 100 test hours. Realignment of this small amount of workload would not be prudent.




The four facilities in this subcategory are all located at Pax River and include capabilities for ground and inflight measurements of antenna performance, communications equipment and combat identification systems.

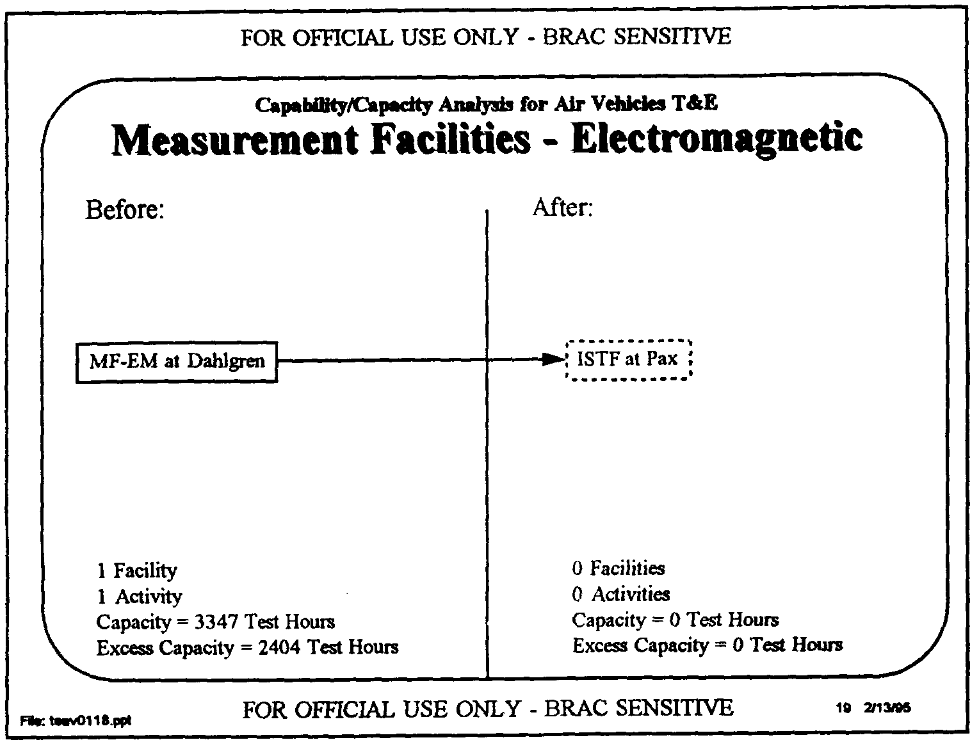



The GVT facility (Edwards) supports flutter flight testing.

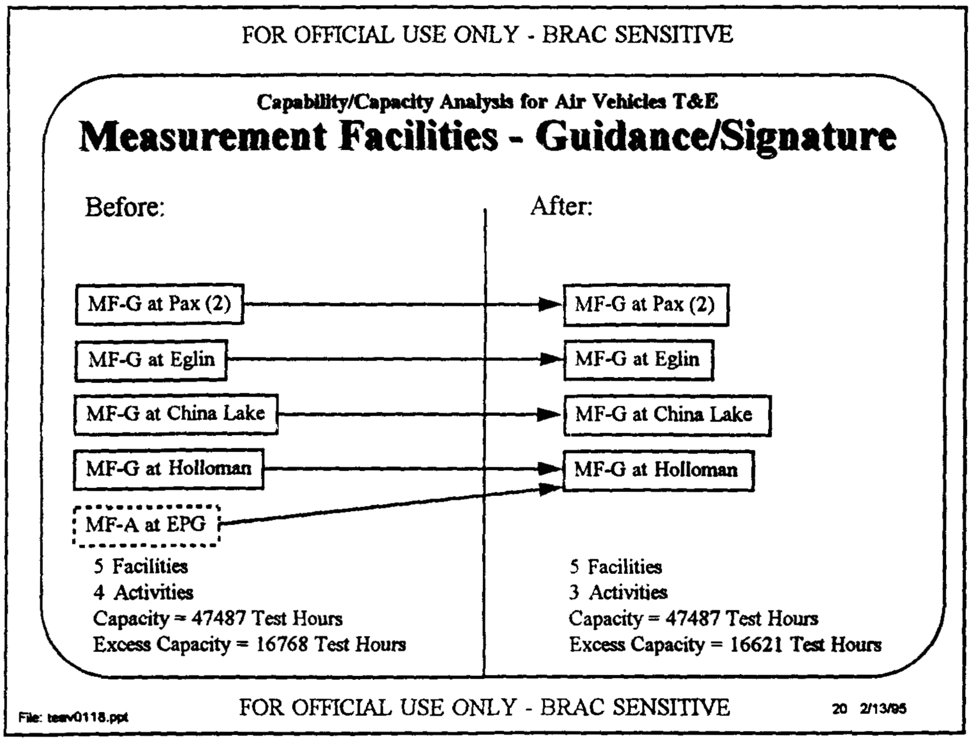
The McKinley Climatic Lab (Eglin) and Sea Level Test Chamber (Pt Mugu) are climatic test hangars performing very similar functions. The McKinley facility is larger and more capable and has sufficient excess capacity to absorb the Sea Level Test Chamber workload whereas the Pt Mugu excess capacity is insufficient. This is a realistic realignment opportunity but the impact on other workload at the Sea Level Test Chamber must be assessed.

The Environmental Test Facility (EPG), Environmental Simulation (YPG) and Environmental Test Complex (China Lake) have similar capabilities except that the Environmental Simulation and Environmental Test Complex facilities are primarily armament/weapon test facilities designed to handle explosive materials. The workload could technically be accommodated at one facility; however, the Air Vehicle T&E workload at each of these facilities is less than 15% and barely exceeds the 100 test hour consideration threshold. Realignment of these facilities should be considered under Armament/Weapons T&E.

The Product Quality and Assurance Facility (Indianapolis) performs some unique functions for the Navy involving investigation of electronic component failures. The environmental test chambers at this facility are similar to other facilities such as the AEEF (Pax River) but the others do not have much of the lab equipment used for failure analysis. Only 20% of the workload is Air Vehicle T&E. If Indianapolis was closed the workload could probably be transferred to Pax River but substantial equipment transfer would be required to augment technical capabilities.

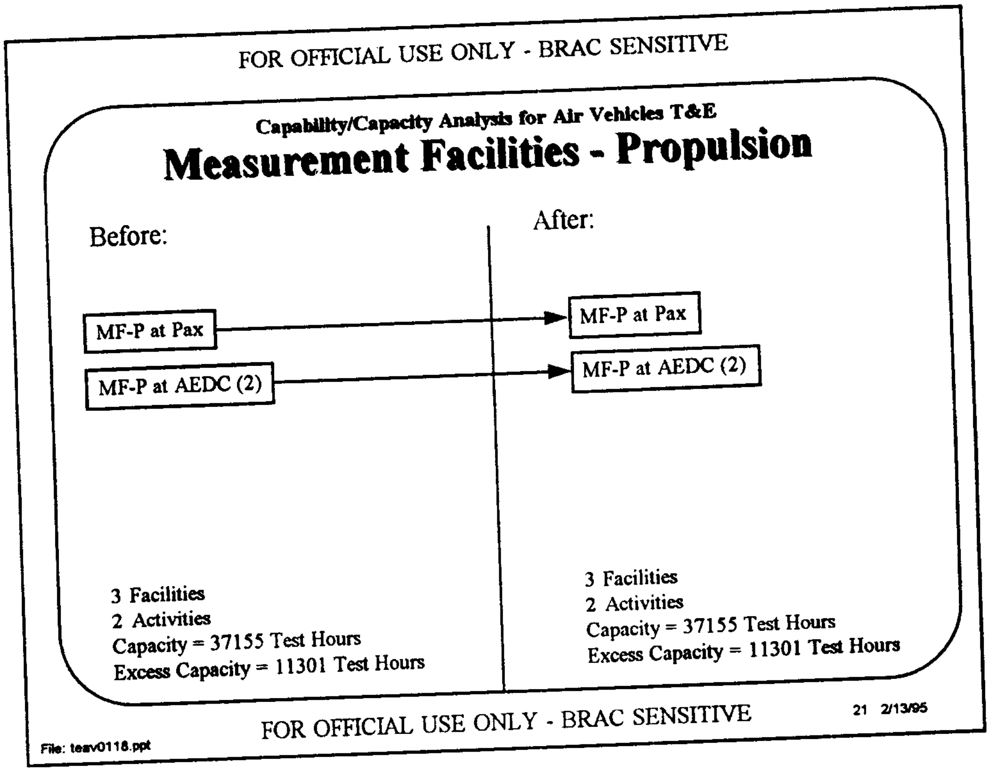



The Electromagnetic Vulnerability Assessment Facility (Dahlgren) was the only facility in this sub category. Similar types of testing can be performed in the ACETEF at Pax River but that facility lacks some of the technical capabilities which would require transfer of equipment if the workload were to be realigned. Air Vehicle T&E is 35% of the workload at the Dahlgren facility.

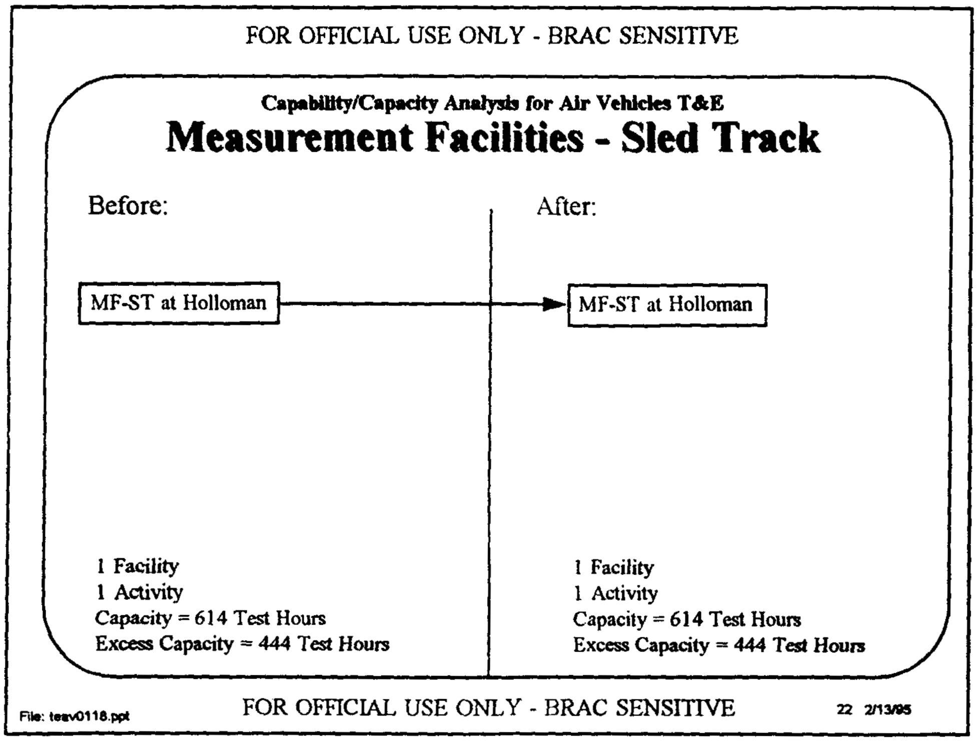



The Surveillance and Topographical Radar System (Pax River) and Electro-optical and Reconnaissance Systems (Pax River) facilities provide ground based support for flight testing of airborne radar and electro-optical sensor systems. The Airborne/Surface Multispectral Signature Measurement Facility (Eglin) provides ground and inflight spectral measurements for a variety of sensor types and primarily supports armament/weapon testing (8% AV T&E). These facilities all had unique capabilities supporting open air range testing.

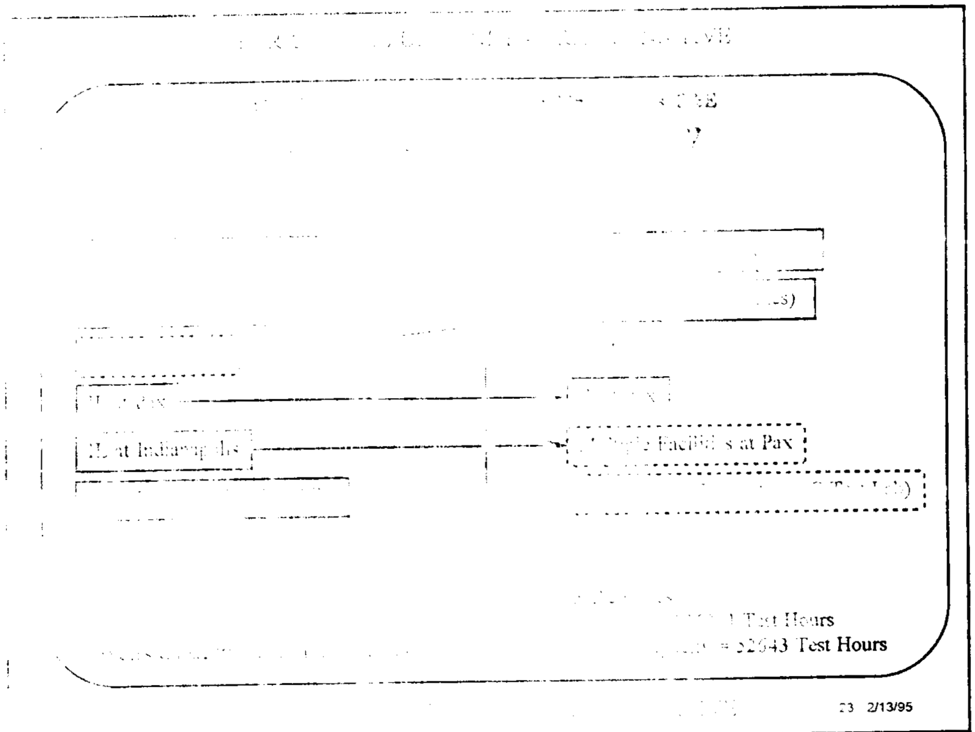
The IR Seekers facility (China Lake) is a specialized lab for development of Infrared seekers for missiles and considered not realistic for realignment under Air Vehicle T&E (10% of workload). The CIGTF at Holloman is a unique facility (geographically constrained) for ground-based testing of inertial guidance platforms and GPS. Both were considered unique (within AV T&E) ground test capabilities.




The Propulsion System Evaluation Facility (Pax River) consists of several labs and specialized facilities to ground test engine-related systems and subsystems for both fixed and rotary-wing aircraft. The two AEDC facilities are unique specialized wind tunnels for evaluating the internal aerodynamics of full-scale jet engines and are considered national test assets. All of these are large facilities with unique technical capabilities.




The High Speed Sled Track (Holloman) was the only sled track facility reporting significant Air Vehicle T&E workload.

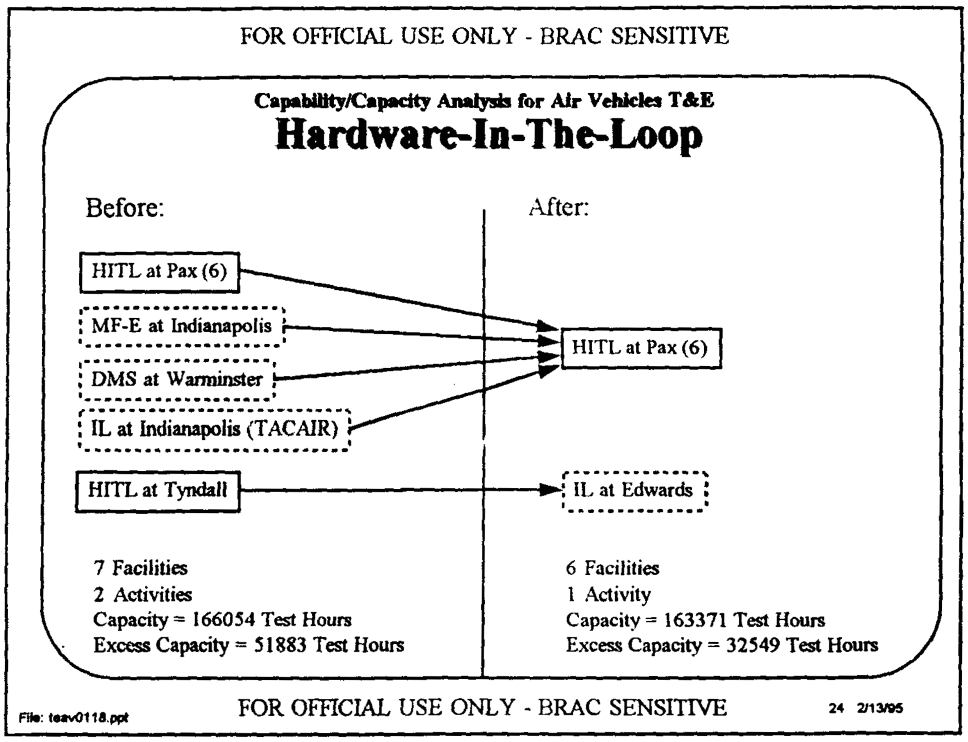



[illegible] for avionics [illegible] (Boards) is a [illegible] associated test [illegible]

[illegible] integrated fixed-wing avionics systems. The Helicopter Mission Systems Support Facility (Pax [illegible] systems integration [illegible]

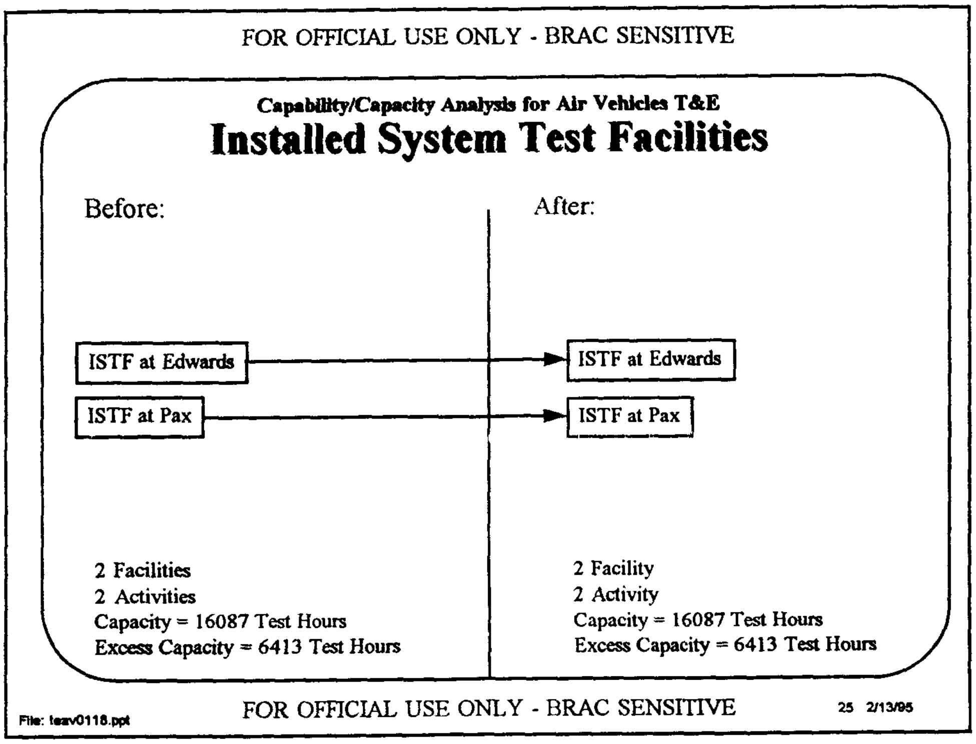
The TACAIR Pod Laboratory (Indianapolis) is a collection of specialized [illegible] cruise missile sensors and guidance systems. [illegible] of the workload is Air Vehicle T&E. [illegible] could be moved to one of several facilities at Pax River [illegible] the Integrated Aircraft Test Lab.

The Integrated [illegible] supports acquisition of integrated avionics systems [illegible] workload). The facility contains [illegible] has capabilities similar to those found at several Pax River test facilities (some of which were [illegible] are Navy-specific). If [illegible] into several facilities at Pax River.

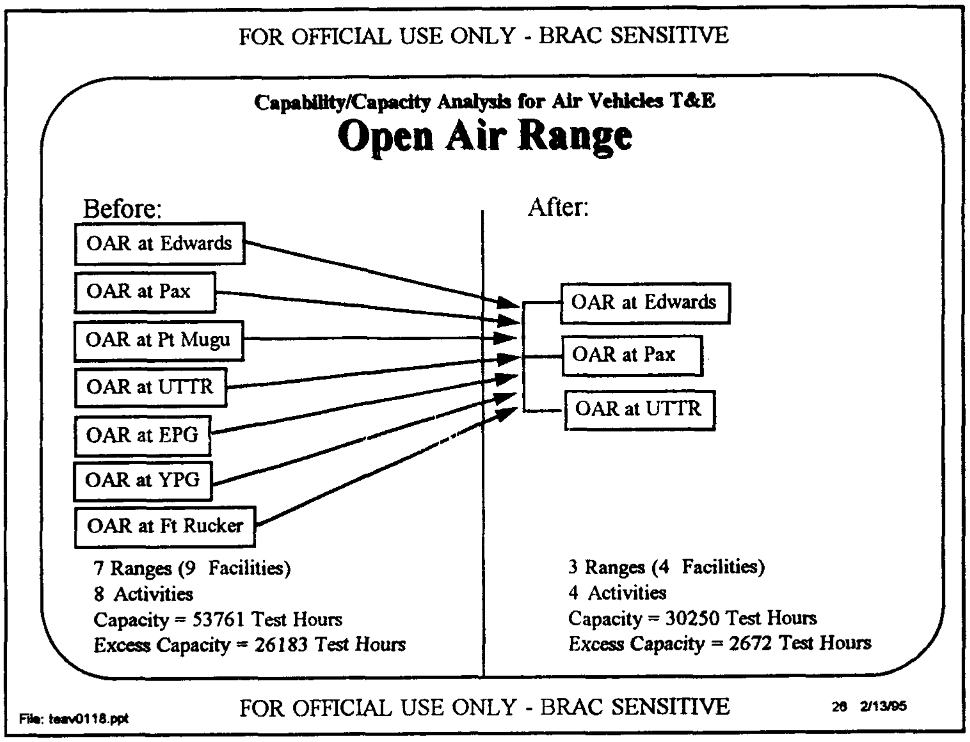



Six facilities at Pax support development, flight testing and in service engineering for avionics, air crew systems, electrical systems, flight control computers, aircraft stores and aircraft ground support equipment.

The Radar Test Facility (Tyndall) conducts ground-based operational testing of OFP's for F-15 and F-16 airborne radars. Several other facilities, such as the IFAST (Edwards), have the technical capabilities to conduct this type of testing. Most of the weapon-specific hardware would need to be transferred if this facility were realigned. Since the RTF facility is owned by an operational command, an assessment of the impact on the user would be needed.




The BAF/ECIT (Edwards) and ACETEF (Pax River) are complementary facilities. The ACETEF has substantial technical capabilities not found in the BAF/ECIT while the much larger BAF can support bomber-sized aircraft.




The optimization model suggested consolidating all Air Vehicle T&E Open Air Range work into three activities, AFFTC Edwards, NAWC Pax River and NAWC Pt Mugu. The open air ranges at AFFTC Edwards and NAWC Pax River are jointly capable of accommodating DoD technical requirements for all Open Air Range Air Vehicle T&E with few exceptions. One such exception is overland test requirements for cruise missile testing, currently conducted at UTTR. The combination of OAR facilities at AFFTC Edwards, NAWC Pax River and UTTR Hill satisfies the capability and capacity requirements for Air Vehicle T&E workload with the minimum number of activities. While technically a separate activity, AQTD is a tenant at the AFFTC Edwards and would remain open to accommodate Army rotary-wing testing.

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**Capability/Capacity Analysis for Air Vehicles T&E**

## Summary of Potential Realignments

| Test Facility Category | Number of Facility Realignments |
|---|---|
| Digital Models and Simulations | 1 |
| MF - Avionics | 2 |
| MF - Communications | 0 |
| MF - Environmental | 4 |
| MF - Electromagnetic | 1 |
| MF - Guidance | 0 |
| MF - Propulsion | 0 |
| MF - Sled Tracks | 0 |
| Integration Laboratory | 2 |
| Hardware-In-The-Loop | 1 |
| Installed System Test | 0 |
| Open-Air-Range | 5 |
| **Total** | **16** |

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The table summarizes the number of potential facility realignments from the preceding capability/capacity analysis. Eight of the 16 potential realignments involve facilities located at "non-core" activities. These eight potential realignments were formulated into the six AV T&E JCSG alternatives. The remaining 8 involve "core" activities for which no alternatives were jointly developed.

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## Capability/Capacity Analysis for Air Vehicles T&E
## Adjusted Optimization Model Workload (Test Hours)

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| **AFFTC, Edwards** | 85 | 270 | 2360 | 71417 | | 121 | 13395 |
| **NAWC, Pax River** | 81 | | 27405 | 11065 | 130822 | 10496 | 9340 |
| **NAWC, Pt Mugu** | 69 | | 0 | | | | 0 |
| **AFDTC, Eglin** | 58 | | 5238 | | | | |
| 476 WEG, Tyndall | 47 | | | | 0 | | |
| **UTTR, Hill** | 46 | | | | | | 2217 |
| AQTD, Edwards | 46 | | | | | | 2626 |
| **EPG, Ft Huachuca** | 44 | | 0 | | | | 0 |
| **NAWC, China Lake** | 43 | | 2095 | | | | |
| **YPG, Yuma** | 35 | | 0 | | | | 0 |
| ATTC, Ft Rucker | 34 | | | | | | 0 |
| **AFDTC, Holloman** | 33 | | 27677 | | | | |
| NSWC, Dahlgren | 25 | | 0 | | | | |
| NAWC, Indianapolis | 19 | | 0 | 0 | | | |
| **AEDC, Arnold** | 18 | | 2569 | | | | |
| NAWC, Warminster | 14 | 0 | | | | | |

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The table indicates the workload distribution for the 16 potential realignments of Air Vehicle T&E test facilities. The highlighted (boxed) entries indicate where workload was adjusted from the output of the optimization model. This "best possible" consolidation was based on the capability/capacity analysis for the six test facility categories. In some instances, workload was moved between categories where capability matches existed. In some cases it was assumed that sufficient equipment would be moved from a losing facility to a gaining facility in order to augment the gaining facility's technical capabilities. No considerations were given for the impacts of facility consolidations on other workload at losing facilities. In a number of cases the realigned Air Vehicle T&E workload was less than 20% of the losing facility's total workload. Many of these potential realignments would not be cost effective unless required by closing the host activity.

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# Outline

- AV T&E Baseline
- Optimization Model Outputs
- Capability/Capacity Analysis
- Alternatives
  - JCSG (Non-Core)
  - Other (Core)
- Summary

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## AV T&E JCSG Alternatives

- TE-1 (AV) Realign Ft Rucker Rotary Wing OAR to YPG
  - Not Consistent With Model Results
- TE-2 (AV) Realign AQTD Rotary Wing OAR to YPG
  - Not Consistent With Model Results
- TE-3 (AV) Realign NAWC, Indianapolis ILs to Pax River and Realign NAWC, Indianapolis Product Quality Assurance MF to TBD
- TE-4 (AV) Realign NSWC, Dahlgren EM Vulnerability MF to Pax River
- TE-5 (AV) Realign NAWC, Warminster DM&S Centrifuge to Pax River
- TE-6 (AV) Realign Tyndall RADAR Test HITL to Another Air Force Activity

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In a departure from the approved Analysis Plan, the T&E JCSG restricted the T&E JCSWG to considering realignments only from activities that were not "core". The 10 MRTFB activities were designated "core", leaving 6 activities and only 8 of 51 facilities remaining for realignment consideration. In accordance with T&E JCSG Policy Imperatives, capabilities were to be realigned into MRTFB's having Open Air Ranges. The Air Vehicle T&E JCSWG generated six alternatives for realigning the 8 "non-core" test facilities. Each alternative listed, as potential gaining sites, all "core" activities with any test facility in the same test facility category as that proposed for realignment. In most cases a "most likely" gaining activity was designated.

Alternative TE-1 (AV) recommended realigning the open air range test work from the Army's Ft Rucker test activity. The most likely gaining activity was listed as Yuma Proving Ground because of the Army's stated intention of consolidating all air vehicle testing at Yuma. This was not consistent with the optimization model results and capability analysis which would consolidate all AV T&E OAR testing primarily at AFFTC Edwards and NAWC Pax River. There is sufficient test capacity and infrastructure at the Army's existing AQTD tenant facilities at AFFTC Edwards to absorb this workload without any MILCON expenditures, as would be required to realign the workload at Yuma.

Alternative TE-2 (AV) recommended realigning the air vehicle test work at AQTD to a "core" activity with Yuma, again, "most likely" gaining activity. Again, this was inconsistent with the results of the optimization model.

Exercising this option would undo the current cross-servicing arrangement between the Air Force and the Army. AQTD is a tenant at a MRTFB with an OAR.

The remaining 4 AV T&E JCSG alternatives are consistent with the analysis. None of these realignments would probably be cost effective unless necessitated by closure of the host activity.

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**AV T&E JCSG Alternatives**

## DoD Workload & Capacity With JCSG Alternatives

**(Test Hours/Year)**

| Department | Activities | Facilities | Capacity | Projected Workload | Excess Capacity |
|---|---|---|---|---|---|
| Air Force | 5 | 15 | 199,097 | 118,701 | 80,396 |
| Navy | 3 | 24 | 274,874 | 191,168 | 83,706 |
| Army | 2 | 7 | 12,239 | 9,244 | 2,995 |
| Total | **10** | **46** | 486,210 | 319,113 | **167,097** |
| Reduction from Baseline | 37% | 10% | 5% | | 12% |

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The table shows the reductions from baseline that would result from implementation of the T&E JCSG alternatives. The largest and most significant reduction in excess capacity would come from the realignment of ATTC Ft Rucker. The T&E JCSG alternatives would reduce the number of activities from 16 to 10 and the number of test facilities from 51 to 46. DoD excess capacity would be reduced from 190,499 test hours to 167,097 test hours which is a 12% reduction.

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# Outline

- AV T&E Baseline
- Optimization Model Outputs
- Capability/Capacity Analysis
- Alternatives
  - JCSG (Non-Core)
  - Other (Core)
- Summary

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## AV T&E Other Alternatives

- Potential "Core" Realignments
  - MF - Avionics = 2
  - MF - Environmental = 3
  - Open Air Range = 3
- Open Air Ranges Are the Only Significant Realignment Opportunity
- Optimization Model Showed Air Vehicle OAR Workload Can Be Consolidated into 3 MRTFB
- Capacity Requires Combination of AFFTC Edwards and NAWC Pax River Plus One Other OAR
  - Edwards and Pax Can Accomodate 97% of the Workload
- Capability Requires Inclusion of UTTR for Cruise Missile Testing

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The T&E JCSG alternatives were limited to realignments from "non-core" activities. The capability and capacity analysis shows potential for additional realignments from "core" activities. Two potential consolidations in the Avionics Measurement Facilities subcategory would realign 147 test hours (10% AV T&E) and 117 test hours (21 % AV T&E). Two potential realignments in the Environmental Measurement Facilities subcategory would realign 134 test hours (12% AV T&E) and 131 test hours (15% AV T&E). These are not likely candidates for realignment.

The remaining potential "core" realignments may have merit. The most significant would consolidate open air testing into 3 MRTFB open air ranges. The optimization model showed that the projected AV T&E workload of 27,578 test hours can be consolidated into AFFTC Edwards and NAWC Pax River, with a combined capacity of 24,244 test hours, plus one other open air range. Including AQTD, the Army's tenant activity which uses AFFTC airspace, the combined AV T&E OAR capacity of the two major air vehicle test center ranges is 26,870 test hours or 97% of the DoD projected requirement. Test capability requirements dictate inclusion of UTTR, for cruise missile testing, as a third OAR.

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**AV T&E Other Alternatives**

## Comparison of MRTFB OARs

Requirement: Conduct Air Vehicle Open Air Testing for Full Spectrum of Aircraft (Low to High Speed, Small to Large), Climate, and Topography.
Projected OAR Workload = 27,578 Hours.

| Activity | Functional Value | Capacity (Test Hours) | Number of TFCs Supported |
|---|---|---|---|
| AFFTC, Edwards | 85 | 14624 * | 5 |
| NAWC, Pax River | 81 | 12246 | 5 |
| NAWC, Pt Mugu | 69 | 4787 | 2 |
| UTTR, Hill | 46 | 3380 | 1 |
| EPG, Ft Huachuca | 44 | 646 | 2 |
| YPG, Yuma | 35 | 6028 | 2 |

* Includes AQTD

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The Policy Imperatives in the T&E JCSG Analysis Plan directed that capabilities be consolidated to the maximum extent practical at MRTFB's with open air ranges. The table shows a comparison of MRTFB OAR's involved in Air Vehicle T&E. Excluding AFFTC, the total capacity of all other AV T&E MRTFB OAR's is 27,087 test hours which is insufficient to accommodate the projected workload requirement of 27,578 test hours.

No single MRTFB OAR satisfied all requirements for AV T&E as reflected in the certified data. Functional Value is the best relative indicator of OAR capabilities since 72% of the numerical score was determined by open air range measures of merit including critical air, land and sea space, diversity of topography and climate, and airfield facilities. AFFTC Edwards and NAWC Pax River are clearly the most capable MRTFB OAR's for AV T&E.

The combination of AFFTC Edwards and NAWC Pax River complies with the Policy Imperatives contained in the T&E JCSG Analysis Plan (section 3, annex to appendix D) with respect to "irreplaceable air, land and sea space" (3.a), capability to satisfy test requirements in each test facility category (3.b) and consolidation of capabilities into MRTFB's having open air ranges (3.c).

It is not likely that any one MRTFB OAR could be expanded sufficiently to accommodate the entire projected workload of 27,578 test hours which is nearly twice the available capacity at either AFFTC Edwards or NAWC Pax River. Both AFFTC Edwards and NAWC Pax River indicated, in the certified data, that the upper limit of safe open air test operations is on the order of 140% of peak demonstrated capacity.

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**AV T&E Other Alternatives**

## Core-1 (AV)

- Realign All AV T&E OAR Workload To AFFTC Edwards, NAWC Pax River, and UTTR Hill
  - NAWC Pt Mugu to NAWC Pax River
  - ATTC Ft Rucker and YPG Yuma to AFFTC Edwards (AQTD)
  - EPG Ft Huachuca to UTTR Hill
- Rationale: Reduces AV T&E Baseline
  - OAR Excess Capacity from 26,183 to 4,069
  - Facilities Conducting OAR AV Test from 9 to 4
  - Activities Conducting OAR AV Test from 8 to 4

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Realigning OAR workload to 3 MRTFB's could conceptually reduce AV T&E OAR excess capacity from a baseline of 26,813 test hours to a minimum of 2,672 test hours. However this would require dividing Army rotary-wing OAR testing between AFFTC Edwards (AQTD) and NAWC Pax River. A more logical (i.e., cost-effective) consolidation would be to move Navy testing to Pax River, Army rotary-wing testing to Edwards, and Army unmanned air vehicle testing to UTTR. This would require increasing Edwards' OAR capacity to approximately 110% of demonstrated peak. The resulting excess capacity would be 4069 test hours.

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**AV T&E Other Alternatives**

## DoD Workload & Capacity

**With JCSG Alternatives Plus OAR Consolidation**

**(Test Hours/Year)**

| Department | Activities | Facilities | Capacity | Projected Workload | Excess Capacity |
|---|---|---|---|---|---|
| Air Force | 5 | 15 | 199,097 | 126,158 | 72,939 |
| Navy | 3 | 23 | 270,087 | 191,168 | 78,919 |
| Army | 3 | 5 | 5,781 | 1,787 | 3,994 |
| Total | **11** | **43** | 474,965 | 319,113 | **155,852** |
| Reduction from Baseline | 31% | 16% | 7% | | 18% |

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The table shows the reductions from baseline that would result from implementation of the T&E JCSG alternatives coupled with the CORE-1 (AV) consolidation of open air range testing at 3 MRTFB's. The reduction in OAR excess capacity is doubled over that of the T&E JCSG alternatives alone. Since AQTD Edwards is added back as a tenant at Edwards (vice realignment to Yuma), the number of activities would be reduced from 16 (baseline) to 11, and the number of facilities would be reduced from 51 to 43. DoD excess capacity would be reduced to 155,852 test hours which represents an 18% reduction.

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**AV T&E Other Alternatives**

## Additional Alternative

- Realign Sea Level Climatic Chamber (Pt Mugu) with McKinley Climatic Lab (Eglin)
- Rationale
  - Nearly All Workload (90%) is T&E
  - Sufficient Excess Capacity at McKinley to Absorb Entire Projected Workload
  - Would Allow Mothballing Entire Facility

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The one ground test facility consolidation that might be cost effective is the realignment of workload from the Sea Level Climatic Chamber (Pt Mugu) to the McKinley Climatic Lab (Eglin). Such a realignment has already been agreed to by the Services as part of Project Reliance. The majority of Sea Level Test Chamber workload is T&E (40% AV T&E, 40% A/W T&E, and 10% other T&E). The AV T&E capacity for McKinley (6816 test hours) is substantially greater than the Sea Level Test Chamber (575 test hours). McKinley has the required technical capabilities and sufficient excess capacity to absorb the projected workload of both facilities, allowing the Sea Level Test Chamber to be closed. The potential loss of backup test capability would have to be assessed. This realignment would reduce AV T&E excess capacity by only 248 test hours.

# Outline

- AV T&E Baseline
- Optimization Model Outputs
- Capability/Capacity Analysis
- Alternatives
  - JCSG (Non-Core)
  - Other (Core)
- Summary

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# Summary
# Air Vehicle T&E

| Options | Activities | Facilities | DoD Capacity (Test Hours) | DoD Excess Capacity (Test Hours) | Comments |
|---|---|---|---|---|---|
| Baseline | 16 | 51 | 509,612 | 190,499 | |
| Non-Core (JCSG) Alternatives | 10<br><37%> | 46<br><10%> | 486,210<br><5%> | 167,097<br><12%> | Non-Core Realigned |
| Core-1 (AV) OAR Realignment | 11<br><31%> | 43<br><16%> | 474,965<br><7%> | 155,852<br><18%> | Non-Core Realigned Plus MRTFB OAR Consolidation |
| Add'l Alternative * | 10<br><37%> | 42<br><18%> | 474390<br><7%> | 155604<br><18%> | Core and Non-Core Realigned |

* Maximum Reductions Achievable

<> = % Reduction

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The table summarizes the potential consolidations that might be achieved in test facilities that conduct workload in the Air Vehicle T&E functional area. The relatively modest reduction that might result from these potential realignments is an indication that the Air Vehicle T&E infrastructure is reasonably well consolidated.

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**AV T&E Analysis**

## Summary

- Completion of AV T&E Analysis by Air Force Indicated 16 "Potential" Facility Realignments Opportunities
- T&E JCSG Non-Core Alternatives Included 8 of the 16
  - 1 DM&S, 2 MF, 2 IL, 1 HITL, 2 OAR
- Other Alternatives Address Core Consolidation
  - 1 MF, 3 OAR
- Most Potential Realignments Not Likely to be Cost Effective
- Consolidation of OAR Testing at the Two Major Air Vehicle Test Centers May Have Merit

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The analysis indicates that both major air vehicle test centers (AFFTC Edwards and NAWC Pax River) are required to support the projected OAR test workload for Air Vehicle T&E. While some duplication exists between test facilities at these two activities, it is generally in areas which support/augment OAR flight testing and is therefore needed to support the projected workload. Except for some specialized ground test facilities that are impractical to relocate, most of the test facilities required for Air Vehicle T&E are currently consolidated at two MRTFB open air ranges, AFFTC Edwards and NAWC Pax River. Further consolidation of fixed and rotary wing open air range testing to these two activities may be beneficial to the DoD.

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# Appendix to Annex 3

Supplemental Information

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## AV T&E Baseline
# Air Force Workload and Capacity

| Test Facility Category | Facilities | Capacity (Test Hours) | Projected Workload (Test Hours) | Excess Capacity (Test Hours) | % Excess Capacity |
|---|---|---|---|---|---|
| Digital Models and Simulations | 1 | 1987 | 270 | 1717 | 81 |
| MF - Avionics | 1 | 1822 | 1230 | 592 | 17 |
| MF - Communications | | | | | |
| MF - Environmental | 2 | 8386 | 5951 | 2435 | 20 |
| MF - Electromagnetic | | | | | |
| MF - Guidance/Signature | 2 | 42445 | 27450 | 14995 | 89 |
| MF - Propulsion | 2 | 4815 | 2569 | 2246 | 20 |
| MF - Sled Tracks | 1 | 614 | 170 | 444 | 100 |
| Integration Laboratory | 2 | 118999 | 69485 | 49514 | 88 |
| Hardware-In-The-Loop | 1 | 2683 | 1932 | 751 | 1 |
| Installed System Test | 1 | 1968 | 121 | 1847 | 29 |
| Open-Air-Range | 2 | 15378 | 9523 | 5855 | 22 |
| Total | 15 | 199097 | 118701 | 80396 | 42 |

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## AV T&E Baseline

# Navy Workload and Capacity

| Test Facility Category | Facilities | Capacity (Test Hours) | Projected Workload (Test Hours) | Excess Capacity (Test Hours) | % Excess Capacity |
|---|---|---|---|---|---|
| Digital Models and Simulations | 1 | 1393 | 1003 | 390 | 19 |
| MF - Avionics | 2 | 3156 | 1137 | 2019 | 57 |
| MF - Communications | 4 | 2091 | 1136 | 955 | 100 |
| MF - Environmental | 3 | 24950 | 16942 | 8008 | 66 |
| MF - Electromagnetic | 1 | 3347 | 943 | 2404 | 100 |
| MF - Guidance/Signature | 3 | 5042 | 3269 | 1773 | 11 |
| MF - Propulsion | 1 | 32340 | 23285 | 9055 | 80 |
| MF - Sled Tracks | | | | | |
| Integration Laboratory | 3 | 19168 | 12321 | 6847 | 12 |
| Hardware-In-The-Loop | 6 | 163371 | 112239 | 51132 | 99 |
| Installed System Test | 1 | 14119 | 9553 | 4566 | 71 |
| Open-Air-Range | 2 | 17033 | 9340 | 7693 | 29 |
| Total | 27 | 286010 | 191168 | 95242 | 50 |

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## AV T&E Baseline
# Army Workload and Capacity

| Test Facility Category | Facilities | Capacity (Test Hours) | Projected Workload (Test Hours) | Excess Capacity (Test Hours) | % Excess Capacity |
|---|---|---|---|---|---|
| Digital Models and Simulations | | | | | |
| MF - Avionics | 2 | 1177 | 264 | 913 | 26 |
| MF - Communications | | | | | |
| MF - Environmental | 2 | 1978 | 265 | 1713 | 14 |
| MF - *Electromagnetic* | | | | | |
| MF - Guidance/Signature | | | | | |
| MF - Propulsion | | | | | |
| MF - Sled Tracks | | | | | |
| Integration Laboratory | | | | | |
| Hardware-In-The-Loop | | | | | |
| Installed System Test | | | | | |
| Open-Air-Range | 5 | 21350 | 8715 | 12635 | 48 |
| Total | 9 | 24505 | 9244 | 15261 | 8 |

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# GLOSSARY

| | |
|---|---|
| A-A | Air-to-Air |
| ACC | Air Combat Command |
| AEDC | Arnold Engineering and Development Center |
| AF | Air Force |
| AFDTC | Air Force Development Test Center |
| AFEWES | Air Force Electronic Warfare Evaluation Simulator |
| AFFTC | Air Force Flight Test Center |
| AFMC | Air Force Materiel Command |
| A-G | Air-to-Ground |
| APG | Aberdeen Proving Ground |
| AQTD | Aviation Qualification Test Directorate |
| ARDEC | Armament R&D Engineering Center |
| ARL | Aerospace Research Laboratory |
| ATIC | Avionics Test and Integration Complex |
| ATTC | Aviation Technical Test Center |
| AV | Air Vehicles |
| AW | Armament/ Weapons |
| BOS | Base Operating Support |
| BRAC | Base Realignment and Closure |
| CIGTF | Central Inertial Guidance Test Facility |
| COBRA | Cost of Base Realignment Actions |
| CSF | Common Support Function |
| DM&S | Digital Modeling and Simulation |
| DoD | Department of Defense |
| EC | Electronic Combat |
| EM | ElectroMagnetic |
| EMD | Engineering and Manufacturing Development |
| EMTE | ElectroMagnetic Test Environment |
| EPG | Electronic Proving Ground |
| FC | Functional Capacity |
| FV | Functional Value |
| HITL | Hardware-In-The-Loop |
| HSTT | High Speed Test Track |
| IL | Integration Laboratory |
| ISE | In-Service Engineering |
| ISTF | Installed Systems Test Facility |
| JCSG | Joint Cross Service Group |
| JCSWG | Joint Cross Service Working Group |
| LJCSG | Laboratory Joint Cross Service Group |
| M&S | Modeling and Simulation |
| MF | Measurement Facility |
| MILDEP | Military Department |

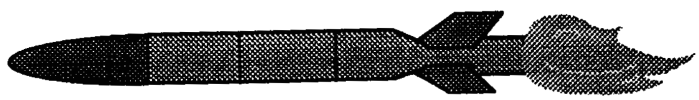
| | |
|---|---|
| MRDEC | Missile R&D Engineering Center |
| MRTFB | Major Range and Test Facility Base |
| MV | Military Value |
| NAWC | Naval Air Warfare Center |
| NPV | Net Present Value |
| NSWC | Naval Surface Warfare Center |
| OAR | Open Air Range |
| R&D | Research and Development |
| RCS | Radar Cross Section |
| RDT&E | Research, Development, Test and Evaluation |
| REDCAP | REal-time Digitally Controlled Analyzer/Processor |
| ROI | Return On Investment |
| ROM | Rough Order of Magnitude |
| RTTC | Redstone Technical Test Center |
| S&T | Science and Technology |
| T&E | Test and Evaluation |
| TFC | Test Facility Category |
| TOA | Total Obligation Authority |
| UTTR | Utah Test and Training Range |
| WEG | Weapons Effectiveness Group |
| WPAFB | Wright-Patterson Air Force Base |
| WSMR | White Sands Missile Range |
| YPG | Yuma Proving Ground |

# Annex 2

# Air Force BRAC '95 Analysis of T&E Infrastructure

## Completion of T&E JCSG Analysis Plan

## Armament/Weapons T&E Analysis



February 1995

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# Annex 2
# of the
# Air Force BRAC '95 Analysis
# of
# T&E Infrastructure

## Completion of T&E JCSG Analysis Plan

## Armament/Weapons T&E Analysis

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## Purpose

- Complete T&E JCSG Analysis Plan for Armament/Weapons Functional Area
  - Air-to-Air
  - Air-to-Surface
  - Surface-to-Air

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The purpose of this document is to complete the Test and Evaluation (T&E) Joint Cross Service Group (JCSG) Analysis Plan for the Armament/Weapons functional area. During the joint development of alternatives, the T&E JCSG only focused on "non-core" T&E activities and restricted the T&E Joint Cross Service Working Group (JCSWG) from including realignments that involved "core" T&E activities. In order to provide a basis for addressing excess capacity among "core" activities, the Air Force completed the T&E JCSG analysis plan by using certified data to address realignments at the test facility level.

Per T&E JCSG decision, Armament/Weapons includes air-to-air, air-to-surface, and surface-to-air weapon system test and evaluation. Surface-to-surface T&E is not included in this analysis.

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# Outline

- Armament/Weapons T&E Baseline
- Optimization Model Outputs
- Capability/Capacity Analysis
- DoD Requirements Analysis
- Alternatives
- Summary

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This annex is organized into five (5) sections that cover the key elements of the T&E JCSG Analysis Plan as follows:

a. The "Armament/Weapons T&E Baseline" section establishes the current DoD infrastructure, such as number of activities and facilities, and projects capacity, workload, and excess capacity data to the FY2001 time frame. All the data come from the T&E JCSG.

b. The "Optimization Model Outputs" section addresses the workload assignments and realignments which resulted from model runs approved by the T&E JCSG.

c. The "Capability/Capacity Analysis" section identifies facility mismatches and facility consolidation opportunities, and adjusts optimization model workload assignments accordingly.

d. The "DoD Requirements Analysis" section ensures potential realignment opportunities meet DoD requirements and T&E Policy Imperatives.

e. The "Alternatives" section describes potential realignment options.

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**Armament/Weapons T&E Baseline**

## DoD Activities and Functional Values

| Dept | Activity | Functional Value | # A/W T&E Facilities | MRTFB |
|---|---|---|---|---|
| Air Force | AFDTC Eglin | 82 | 11 | Yes |
| | AFDTC Holloman | 30 | 2 | Yes |
| | AEDC Arnold | 16 | 2 | Yes |
| | **Total Air Force** | | **15** | |
| Navy | NAWC Pt Mugu | 77 | 12 | Yes |
| | NAWC China Lake | 57 | 32 | Yes |
| | NAWC Pax River | 57 | 1 | Yes |
| | NAWC WSMR | 25 | 1 | No |
| | NSWC Dahlgren | 17 | 2 | No |
| | NSWC Indian Head | 14 | 2 | No |
| | NSWC Crane | 13 | 3 | No |
| | **Total Navy** | | **53** | |
| Army | White Sands Missile Range | 50 | 5 | Yes |
| | Yuma Proving Ground | 29 | 4 | Yes |
| | Redstone Tech Test Center | 21 | 4 | No |
| | **Total Army** | | **13** | |
| **DoD Total** | | | **81** | |

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Based on T&E JCSG evaluation of certified data, thirteen (13) DoD activities were determined to be Armament/Weapons T&E activities. These activities and their Armament/Weapons T&E Functional Values (FV) are:

a. Air Force Development Test Center (AFDTC) Eglin AFB, FL, FV=82
b. Air Force Development Test Center (AFDTC) Holloman AFB, NM, FV=30
c. Arnold Engineering Development Center (AEDC) Arnold AFS, TN, FV=16
d. Naval Air Warfare Center (NAWC) Pt Mugu, CA, FV=77
e. Naval Air Warfare Center (NAWC) China Lake, CA, FV=57
f. Naval Air Warfare Center (NAWC) Patuxent (Pax) River, MD, FV=57
g. Naval Air Warfare Center (NAWC) White Sands Missile Range (WSMR), NM, FV=25
h. Naval Surface Warfare Center (NSWC) Dahlgren, VA, FV=17
i. Naval Surface Warfare Center (NSWC) Indian Head, MD, FV=14
j. Naval Surface Warfare Center (NSWC) Crane, IN, FV=13
k. White Sands Missile Range (WSMR), White Sands, NM, FV=50
l. Yuma Proving Ground (YPG), Yuma, AZ, FV=29
m. Redstone Technical Test Center (RTTC), Redstone Arsenal, AL, FV=21

Of the thirteen (13) activities, seven (7) are Major Range and Test Facility Bases (MRTFB's). The Air Force has three (3) activities and fifteen (15) facilities; the Navy has seven (7) activities and fifty-three (53) facilities; and the Army has three (3) activities and thirteen (13) facilities. The Air Force at AFDTC Eglin scored the highest functional value (82 points out of 100) which indicates AFDTC Eglin is the most capable activity for conducting Armament/Weapons T&E.

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**Armament/Weapons T&E Baseline**

## DoD T&E Facilities

| Activity | Functional Value | DM&S | MF* | IL | HITL | ISTF | OAR | |
|---|---|---|---|---|---|---|---|---|
| AFDTC Eglin | 82 | 1 | 5 | - | 1 | 1 | 3 | (1 Range) |
| NAWC Pt Mugu | 77 | 1 | 7 | 1 | *2 | - | 1 | (1 Range) |
| NAWC China Lake | 57 | 5 | 18 | 4 | 3 | - | 2 | (1 Range) |
| NAWC Pax River | 57 | - | - | - | - | 1 | - | |
| WSMR | 50 | - | 2 | - | - | - | *3 | (1 Range) |
| AFDTC Holloman | 30 | - | 2 | - | - | - | - | |
| YPG | 29 | - | 1 | - | - | - | 3 | (1 Range) |
| NAWC WSMR | 25 | - | - | - | - | - | 1 | (Tenant) |
| RTTC | 21 | - | 3 | - | - | - | 1 | (1 Range) |
| NSWC Dahlgren | 17 | - | 2 | - | - | - | - | |
| AEDC Arnold | 16 | - | 2 | - | - | - | - | |
| NSWC Indian Head | 14 | - | 2 | - | - | - | - | |
| NSWC Crane | 13 | - | 3 | - | - | - | - | |
| **Total** | | 7 | 47 | 5 | 6 | 2 | 14 | **(6 Ranges)** |

**Note: * = Capability Mismatches**

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The location of the eighty-one (81) Armament/Weapons T&E facilities and the number of facilities in each test facility category (TFC) are identified on this chart. Seven (7) facilities were categorized by the T&E activities in the digital modeling and simulation (DM&S) category, forty-seven (47) facilities were categorized in the measurement facility (MF) category, five (5) facilities were categorized in the integration laboratory (IL) category, six (6) facilities were categorized in the hardware-in-the-loop (HITL) category, two (2) facilities were categorized in the installed system test facility (ISTF) category, and fourteen (14) facilities/six (6) ranges were categorized in the open air range (OAR) category. This chart clearly indicates the potential duplication of facilities and ranges which support Armament/Weapons T&E. The chart also shows three (3) activities (AFDTC Eglin, NAWC Pt Mugu, and NAWC China Lake) have facilities in multiple test facility categories. Two (2) activities (NAWC Pax River and NAWC WSMR) have only one facility which supports Armament/Weapons T&E. Five (5) activities conduct only measurement facility testing (AFDTC Holloman, NSWC Dahlgren, AEDC Arnold, NSWC Indian Head, and NSWC Crane).

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**Armament/Weapons T&E Baseline**

## DoD Workload (Test Hours)

| Activity | Functional Value | DM&S | MF* | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| AFDTC Eglin | 82 | 39,324 | 13,144 | | 12,085 | 168 | 7,598 |
| NAWC Pt Mugu | 77 | 3,916 | 18,275 | 5,774 | *39,225 | | 4,068 |
| NAWC China Lake | 57 | 12,065 | 45,387 | 7,594 | 1,357 | | 2,169 |
| NAWC Pax River | 57 | | | | | 624 | |
| WSMR | 50 | | 7,608 | | | | *13,275 |
| AFDTC Holloman | 30 | | 5,129 | | | | |
| YPG | 29 | | 127 | | | | 2,055 |
| NAWC WSMR | 25 | | | | | | 1,791 |
| RTTC | 21 | | 30,089 | | | | 786 |
| NSWC Dahlgren | 17 | | 954 | | | | |
| AEDC Arnold | 16 | | 2,107 | | | | |
| NSWC Indian Head | 14 | | 2,196 | | | | |
| NSWC Crane | 13 | | 1,142 | | | | |

Note: * = Capability Mismatches

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The thirteen (13) activities involved in Armament/Weapons T&E are listed in descending order of functional value. Each activity's FY2001 projected workload is identified under the six (6) test facility categories. The FY2001 workload was estimated by taking 72% [based on OSD (Comptroller) FYDP projections] of the FY92/FY93 average Armament/Weapons T&E workload as reported in certified data. These data were inputs to the optimization model and contain significant capability and capacity mismatches in the measurement facility category, within White Sands Missile Range's open air range numbers, and within Pt Mugu's hardware-in-the-loop numbers. In some cases, facilities with capabilities and capacities cutting across multiple test facility categories were aggregated by activities into a single facility which was categorized under a single test facility category. Other capability/capacity mismatches were generated when an activity categorized a facility in the wrong test facility category. These mismatches in capability and capacity were left in tact for the optimization model runs; thus, the resulting optimization model outputs (workload assignments) contain these mismatches.

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**Armament/Weapons T&E Baseline**

## DoD Capacity (Test Hours)

| Activity | Functional Value | DM&S | MF* | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| AFDTC Eglin | 82 | 57,820 | 30,679 | | 18,611 | 443 | 16,036 |
| NAWC Pt Mugu | 77 | 8,082 | 75,405 | 11,916 | *54,902 | | 11,609 |
| NAWC China Lake | 57 | 27,672 | 72,422 | 14,938 | 3,167 | | 3,986 |
| NAWC Pax River | 57 | | | | | 931 | |
| WSMR | 50 | | 19,215 | | | | *28,116 |
| AFDTC Holloman | 30 | | 23,787 | | | | |
| YPG | 29 | | 201 | | | | 3,997 |
| NAWC WSMR | 25 | | | | | | 3,925 |
| RTTC | 21 | | 45,089 | | | | 1,188 |
| NSWC Dahlgren | 17 | | 1,551 | | | | |
| AEDC Arnold | 16 | | 9,266 | | | | |
| NSWC Indian Head | 14 | | 3,600 | | | | |
| NSWC Crane | 13 | | 2,040 | | | | |

Note: * = Capability Mismatches

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The estimated capacity within each test facility category for an activity was determined by summing the FY86-FY93 historical workload peak for individual T&E facilities within the test facility category. The capability mismatches discussed previously also occur in the DoD capacity test hours.

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## Armament/Weapons T&E Baseline
# DoD Workload and Capacity
### Summary

| Test Facility Category | # A/W T&E Facilities | Capacity (Test Hours) | Projected Workload (Test Hours) | Excess Capacity (Test Hours) |
|---|---|---|---|---|
| Digital Models and Simulations | 7 | 93,574 | 55,305 | 38,269 |
| MF - Environmental | 11 | 142,303 | 56,129 | 86,174 |
| MF - Electromagnetic | 3 | 3,626 | 2,096 | 1,530 |
| MF - Guidance | 13 | 86,726 | 44,228 | 42,498 |
| MF - Guns/Ordnance | 9 | 27,344 | 14,296 | 13,048 |
| MF - Propulsion | 8 | 17,312 | 6,801 | 10,511 |
| MF - Sled Tracks | 3 | 5,944 | 2,608 | 3,336 |
| Integration Laboratory | 5 | 26,854 | 13,368 | 13,486 |
| Hardware-In-The-Loop | 6 | 76,680 | 52,667 | 24,013 |
| Installed System Test Facility | 2 | 1,374 | 792 | 582 |
| Open Air Range | 14 | 68,857 | 31,742 | 37,115 |
| Total | **81** | 550,594 | 280,032 | **270,562** |

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The number of DoD Armament/Weapons T&E facilities, capacity, projected workload, and excess capacity are shown by test facility category and subcategory. DoD excess capacity is 49%, and the large number of facilities providing T&E within many test facility categories and subcategories implies substantial DoD reductions may be possible.

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**Armament/Weapons T&E Baseline**

## Air Force Workload and Capacity

| Test Facility Category | # A/W T&E Facilities | Capacity (Test Hours) | Projected Workload (Test Hours) | Excess Capacity (Test Hours) | % of DoD Excess Capacity |
|---|---|---|---|---|---|
| Digital Models and Simulations | 1 | 57,820 | 39,324 | 18,496 | 48% |
| MF - Environmental (1) | - | - | - | - | - |
| MF - Electromagnetic (2) | - | - | - | - | - |
| MF - Guidance | 3(4) | 37,045 | 10,960 | 26,085 | 61% |
| MF - Guns/Ordnance | 2(4) | 12,870 | 5,301 | 7,569 | 58% |
| MF - Propulsion | 2(4) | 9,266 | 2,107 | 7,159 | 68% |
| MF - Sled Tracks | 2(4) | 4,551 | 2,012 | 2,539 | 76% |
| Integration Laboratory (3) | - | - | - | - | - |
| Hardware-In-The-Loop | 1 | 18,611 | 12,085 | 6,526 | 27% |
| Installed System Test Facility | 1 | 443 | 168 | 275 | 47% |
| Open Air Range | 3(4) | 16,036 | 7,598 | 8,438 | 23% |
| Total | 15 | 156,642 | 79,555 | 77,087 | 28% |

Note: (1) AF A/W Environmental Test Requirements Supported by McKinley Climatic Facility (Air Vehicles)
(2) AF A/W Electromagnetic Test Requirements Supported by Primes (ISTF)
(3) AF A/W Integration Testing Conducted in T&E Support Facilities, Primes, GWEF, Gun Test Facility, Fuze Test Facility, etc. Vice Separate T&E Facilities
(4) No Duplication of Capabilities

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The Air Force has fifteen (15) facilities and contributes 28% of the DoD excess capacity. Test facility categories and subcategories with more than one facility were evaluated for potential duplication. No duplication of Armament/Weapons T&E capability exists. Instead, each facility within a test facility category/subcategory provides a different type of test capability. For example, the measurement facility guns/ordnance subcategory includes the Gun Test Facility and the Warhead Arenas Facility which are distinctly different capabilities. The fifteen (15) Air Force T&E facilities support the entire test process. Measurement facility environmental testing is conducted in the McKinley Climatic Laboratory Facility, which is classified as an Air Vehicle functional area facility, and in the Fuze Test Facility, which is grouped under the measurement facility guidance subcategory. Measurement facility electromagnetic weapons testing is conducted in the Preflight Integration of Munitions and Electronics Systems (PRIMES) Facility which is categorized as an installed system test facility. Separate integration laboratory T&E facilities are not maintained in the Air Force. Instead, integration testing is performed in several T&E support facilities as well as the Gun Test Facility, Fuze Test Facility, Guided Weapons Evaluation Facility (GWEF), and PRIMES Facility. Air Force T&E facilities are managed and controlled by MRTFB/T&E oversight. Air Force research and development (R&D) organizations (laboratories and program offices) are customers of these T&E facilities in lieu of duplicating these types of capabilities under R&D oversight.

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**Armament/Weapons T&E Baseline**

## Navy Workload and Capacity

| Test Facility Category | # A/W T&E Facilities | Capacity (Test Hours) | Projected Workload (Test Hours) | Excess Capacity (Test Hours) | % of DoD Excess Capacity |
|---|---|---|---|---|---|
| Digital Models and Simulations | 6 (1) | 35,754 | 15,981 | 19,773 | 52% |
| MF - Environmental | 7 (1) | 109,432 | 39,283 | 70,149 | 81% |
| MF - Electromagnetic | 2 (1) | 2,711 | 1,458 | 1,253 | 82% |
| MF - Guidance | 9 (1) | 18,962 | 12,928 | 6,034 | 14% |
| MF - Guns/Ordnance | 7 (1) | 14,474 | 8,995 | 5,479 | 42% |
| MF - Propulsion | 6 (1) | 8,046 | 4,694 | 3,352 | 32% |
| MF - Sled Tracks | 1 | 1,393 | 596 | 797 | 24% |
| Integration Laboratory | 5 (1) | 26,854 | 13,368 | 13,486 | 100% |
| Hardware-In-The-Loop | 5 (1) | 58,069 | 40,582 | 17,487 | 73% |
| Installed System Test Facility | 1 | 931 | 624 | 307 | 53% |
| Open Air Range | 4 | 19,520 | 8,028 | 11,492 | 31% |
| Total | 53 | 296,146 | 146,537 | 149,609 | 55% |

Note: (1) Duplication of Capabilities within the Navy

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The Navy has fifty-three (53) facilities and contributes 55% of the DoD excess capacity. Duplication of facilities and capabilities exist in the majority of test facility categories and subcategories which indicates significant opportunities for Navy intra-service consolidation. Navy open air range T&E facilities are managed and controlled by MRTFB/T&E oversight. However, most of the Navy ground facilities are managed and controlled by a mixture of R&D and T&E oversight.

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## Armament/Weapons T&E Baseline
# Army Workload and Capacity

| Test Facility Category | # A/W T&E Facilities | Capacity (Test Hours) | Projected Workload (Test Hours) | Excess Capacity (Test Hours) | % of DoD Excess Capacity |
|---|---|---|---|---|---|
| Digital Models and Simulations | - | - | - | - | - |
| MF - Environmental | 4 (1) | 32,871 | 16,846 | 16,025 | 19% |
| MF - Electromagnetic | 1 | 915 | 638 | 277 | 18% |
| MF - Guidance | 1 | 30,719 | 20,340 | 10,379 | 24% |
| MF - Guns/Ordnance | - | - | - | - | - |
| MF - Propulsion | - | - | - | - | - |
| MF - Sled Tracks | - | - | - | - | - |
| Integration Laboratory | - | - | - | - | - |
| Hardware-In-The-Loop | - | - | - | - | - |
| Installed System Test Facility | - | - | - | - | - |
| Open Air Range | 7 (1) | 33,301 | 16,116 | 17,185 | 46% |
| Total | 13 | 97,806 | 53,940 | 43,866 | 16% |

Note: (1) Duplication of Capabilities within the Army

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The Army has thirteen (13) facilities and contributes 16% of the DoD excess capacity. Potential Army intra-service duplication exists between White Sands Missile Range and Yuma Proving Ground in open air range and measurement facility environmental capabilities. The Army T&E infrastructure is focused on measurement facility and open air range testing. Other test facility category capabilities are managed and controlled by Army R&D oversight.

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**Armament/Weapons T&E Baseline**

## DoD Workload & Capacity Summary

**(Test Hours/Year)**

| Department | Activities | Facilities | Capacity | Projected Workload | Excess Capacity | % of Total Excess Capacity |
|---|---|---|---|---|---|---|
| Air Force | 3 | 15 | 156,642 | 79,555 | 77,087 | 28% |
| Navy | 7 | 53 | 296,146 | 146,537 | 149,609 | 55% |
| Army | 3 | 13 | 97,806 | 53,940 | 43,866 | 16% |
| Total | **13** | **81** | 550,594 | 280,032 | **270,562** | 100% |

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The DoD T&E baseline data indicate that the Navy has fifty-three (53) facilities spread across seven (7) activities which contribute 55% of the DoD excess capacity. The Air Force and Army have substantially fewer facilities and activities which implies they have less opportunities for intra-service consolidation. These data point to two DoD approaches:

a. Intra-service consolidation to reduce duplication within each service's Armament/Weapons T&E infrastructure, and
b. Inter-service consolidation to further reduce the DoD Armament/Weapons T&E infrastructure to the maximum level achievable.

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## Outline

- Armament/Weapons T&E Baseline
- → Optimization Model Outputs
- Capability/Capacity Analysis
- DoD Requirements Analysis
- Alternatives
- Summary

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The preceding baseline Armament/Weapons T&E data were inputs to the Navy-generated and T&E JCSG approved optimization model. The results shown in this section were taken from the T&E JCSG approved optimization model runs.

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## Optimization Model Outputs
### Armament/Weapons T&E

| Activity | MAXSFV (W=0) | MAXSFV (W=95) | MAXSFV (minsites) | MINXCAP (W=100) | MAXSFV (nsite) | MIN NMV (W=95) | Summary |
|---|---|---|---|---|---|---|---|
| AFDTC Eglin | 1 | 1 | **1** | 1 | 1 | 1 | Retain |
| NAWC Pt Mugu | 1 | 1 | **1** | 1 | 1 | 1 | Retain |
| NAWC China Lake | 1 | 1 | **1** | 1 | 1 | 1 | Retain |
| NAWC Pax River | 1 | 1 | **1** | 1 | 1 | 1 | Retain |
| WSMR | 1 | 1 | **1** | 0 | 1 | 1 | Retain |
| AFDTC Holloman | 1 | 1 | **1** | 1 | 1 | 0 | Retain |
| YPG | 0 | 0 | **0** | 0 | 0 | 0 | Realign |
| NAWC WSMR | 0 | 0 | **0** | 1 | 0 | 0 | Realign |
| RTTC | 0 | 0 | **0** | 0 | 0 | 1 | Realign |
| NSWC Dahlgren | 0 | 0 | **0** | 1 | 0 | 0 | Realign |
| AEDC Arnold | 1 | 1 | **1** | 0 | 1 | 1 | Retain |
| NSWC Indian Head | 0 | 0 | **0** | 1 | 0 | 0 | Realign |
| NSWC Crane | 0 | 0 | **0** | 0 | 0 | 0 | Realign |

1 = Activity retained
0 = Activity realigned

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Five optimization model objective functions were run without military value, and one optimization model objective function was run with military value. The results of these model runs are shown with "1" indicating the activity was retained and "0" indicating the activity was realigned. If an activity was retained in the majority of optimization model runs, then it was retained as a "core" Armament/Weapons T&E activity. Activities which were realigned in the majority of optimization model runs were identified as "non-core" Armament/Weapons T&E activities. "Core" activities were:

a. AFDTC Eglin
b. NAWC Pt Mugu
c. NAWC China Lake
d. NAWC Pax River
e. White Sands Missile Range
f. AFDTC Holloman
g. AEDC Arnold

Two additional activities were added by the T&E JCSG to the "core" list. NAWC WSMR was added for its unique Navy sea-based surface-to-air development test capabilities, and Yuma Proving Ground was added for Army rotary wing testing. The MAXSFV (MINSITES) objective function output is shown in bold type. Workload assignments from this objective function are used as the point of departure for follow-on analysis. Other objective functions, such as MINXCAP (minimizing the excess capacity) and other variations of the MAXSFV function, were run to establish thresholds/benchmarks and to assess the sensitivity of workload weighting on workload assignments.

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**Optimization Model Outputs**

**Armament/Weapons Workload (Test Hours)**

**MAXSFV (MINSITES)**

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| AFDTC Eglin | 82 | 55,305 | 29.523 | | 18,611 | 443 | 16,036 |
| NAWC Pt Mugu | 77 | 0 | 59,481 | 11,916 | 34,056 | | 11,609 |
| NAWC China Lake | 57 | 0 | 24,782 | 1,452 | 0 | | 3,986 |
| NAWC Pax River | 57 | | | | | 349 | |
| WSMR | 50 | | 396 | | | | 111 |
| AFDTC Holloman | 30 | | 11,221 | | | | |
| YPG | 29 | | 0 | | | | 0 |
| NAWC WSMR | 25 | | | | | | 0 |
| RTTC | 21 | | 0 | | | | 0 |
| NSWC Dahlgren | 17 | | 0 | | | | |
| AEDC Arnold | 16 | | 755 | | | | |
| NSWC Indian Head | 14 | | 0 | | | | |
| NSWC Crane | 13 | | 0 | | | | |

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Workload assignments are shown for the optimization model objective function MAXSFV (MINSITES). MAXSFV (MINSITES) loads work into the highest functional value activity with capacity to perform all or part of the workload and constrains the total number of activities (sites) to the minimum required to accommodate the workload. In the case of Armament/Weapons, the minimum number of activities (sites) is seven (7). The optimization model realigned workload as follows:

a. AFDTC Eglin was the receiver of digital modeling and simulation, measurement facility, hardware-in-the-loop, installed system test facility, and open air range work. No work was realigned from AFDTC Eglin.

b. All digital modeling and simulation and some hardware-in-the-loop work was realigned from NAWC Pt Mugu. Pt Mugu was the receiver of measurement facility, integration laboratory, and open air range work.

c. All digital modeling and simulation, measurement facility environmental, measurement facility sled track, and hardware-in-the-loop work was realigned from NAWC China Lake. Some measurement facility guns/ordnance and integration laboratory work was also realigned from China Lake. China Lake was the receiver of measurement facility propulsion, measurement facility guidance, and open air range work.

d. Some installed system test facility work was realigned from NAWC Pax River.

e. All measurement facility environmental and most open air range work was realigned from White Sands Missile Range. White Sands Missile Range was the receiver of measurement facility electromagnetic work.

f. All measurement facility sled track work was realigned from AFDTC Holloman. Holloman was the receiver of measurement facility guidance work.

g. All measurement facility and open air range work was realigned from Yuma Proving Ground which eliminated Armament/Weapons T&E at Yuma.
h. All open air range work was realigned from NAWC WSMR which eliminated Armament/Weapons T&E at NAWC WSMR.
i. All measurement facility and open air range work was realigned from Redstone Technical Test Center which eliminated Armament/Weapons T&E at Redstone.
j. All measurement facility work was realigned from NSWC Dahlgren which eliminated Armament/Weapons T&E at Dahlgren.
k. Some measurement facility propulsion work was realigned from AEDC Arnold.
l. All measurement facility work was realigned from NSWC Indian Head which eliminated Armament/Weapons T&E at Indian Head.
m. All measurement facility work was realigned from NSWC Crane which eliminated Armament/Weapons T&E from Crane.

Zeros indicate an activity currently performs work in this test facility category, and its workload was realigned from the activity by the optimization model. Blanks indicate an activity did not submit workload against the test facility category.

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**Optimization Model Outputs**
**Armament/Weapons T&E**

- Optimization Model Workload Assignments Point To:
  - Realignment of 6 out of 13 Activities (Core and Non-Core)
  - Realignment of 29 out of 81 Facilities
  - 28% Reduction in DoD Capacity
  - 58% Reduction in DoD Excess Capacity
- Additional Workload Realignments Needed to Eliminate Capability and Capacity Mismatches

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The optimization model outputs indicate that six (6) of the thirteen (13) activities can be totally realigned and their Armament/Weapons T&E work can be accomplished by higher functional value activities. The realigned (eliminated) activities are:

a. NSWC Crane
b. NSWC Dahlgren
c. NSWC Indian Head
d. Redstone Technical Test Center
e. Yuma Proving Ground
f. NAWC WSMR

The assignment of workload by the optimization model points to the potential to realign twenty-nine (29) facilities which reduces DoD capacity by 28% and reduces DoD excess capacity by 58%. The optimization model workload assignments were accomplished at the test facility category and subcategory levels versus the facility level. Therefore, the capability mismatches discussed previously remain in the data, and the output retains mismatches in four of the test facility categories. These mismatches have to be eliminated by adjusting the optimization model workload assignments to insure valid (feasible) realignment opportunities are evaluated.

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## Outline

- Armament/Weapons T&E Baseline
- Optimization Model Outputs
- → Capability/Capacity Analysis
- DoD Requirements Analysis
- Alternatives
- Summary

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The next section describes the workload realignments required to eliminate capability and capacity mismatches and to consolidate the number of facilities to the maximum extent possible.

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Capability/Capacity Analysis for Armament/Weapons T&E

## Approach

- Use Optimization Model Output as Basis for Further Analysis at the Facility Level
- Identify Capability / Capacity Mismatches and Opportunities to Realign at the Facility Level
  - Based on Model Outputs and Certified Data
- Identify Additional Opportunities to Realign Across Test Facility Categories and Functional Areas
  - Realign to Minimize Number of Activities and Facilities
- Adjust Model Output and Configuration Baseline
  - Move Workload to Activity with Highest FV and Required Capability (Unless Compelling Reason to Do Otherwise)
  - Preserve Test Process and Unique Capabilities

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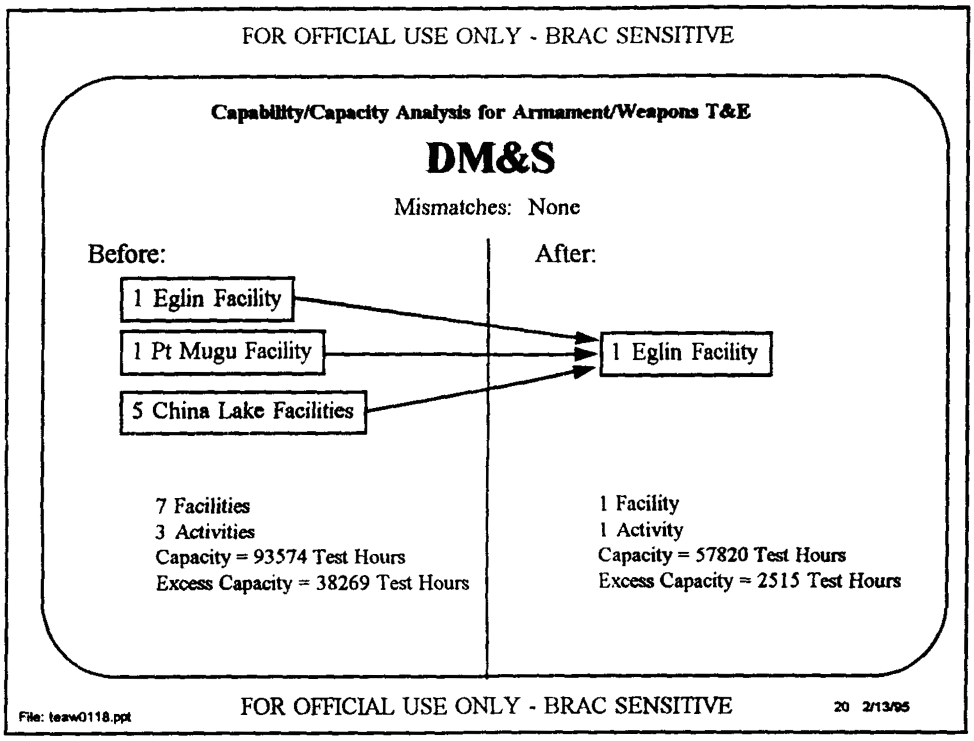
Workload assignments from the optimization model objective function MAXSFV (MINSITES) form the basis for further evaluation of capability and capacity at the facility level. Facilities within a test facility category and subcategory are analyzed to determine whether or not their test capabilities are comparable. Mismatches are identified, and optimization model workload assignments are adjusted to eliminate the mismatches. In some cases, projected workload and capacity are moved to another test facility category to ensure comparable testing capabilities are aligned together. In other cases, excess capacity from another functional area (e.g., Electronic Combat) is moved to provide the needed capacity to realign the only facility performing Armament/Weapons testing at the activity. Workload which is an aggregate of several test facility categories and which is not comparable to other workload in the test facility category is accounted for separately. By removing the mixed workload, other realignment opportunities of comparable test hours are identified. Facility workload and capacity which should have been assigned to another functional area (e.g., Electronic Combat) are eliminated from further Armament/Weapons T&E analysis. Adjustments to the optimization model workload assignments move workload to the activity with the highest functional value and the capability to conduct the testing, unless a compelling reason exists to move the workload elsewhere. Examples of compelling reasons to move workload to a lower functional value activity are to maintain unique test capabilities, such as the NAWC WSMR Desert Ship sea-based surface-to-air development test facility, and to reduce the number of facilities.



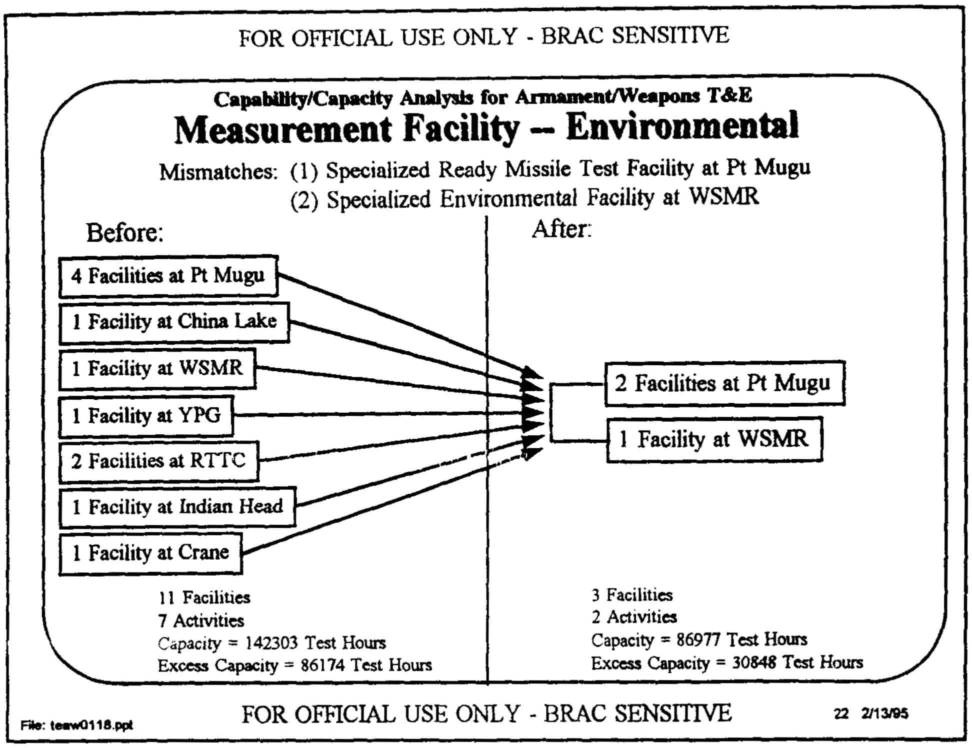

Seven (7) T&E facilities were categorized in the digital modeling and simulation test facility category. The following table lists the seven (7) facilities with their activity, functional value (FV), projected workload, and capacity and lists the optimization model workload assigned to each activity.

| Activity | FV | Name of Facility | Projected Workload | Capacity | Optimization Model Assignments |
|---|---|---|---|---|---|
| Eglin | 82 | *Digital Modeling and Simulation Capability | 39324 | 57820 | 55305 |
| Pt Mugu | 77 | Simulation and Effectiveness Center | 3916 | 8082 | 0 |
| China Lake | 57 | Weapons and Tactics Analysis Center | 137 | 546 | 0 |
| | | System Modeling & Signal Processing Facility | 1108 | 1638 | 0 |
| | | Strike Simulation and Modeling | 5326 | 17486 | 0 |
| | | Air Weapons Digital Modeling & Simulation | 4392 | 6200 | 0 |
| | | Strike Software/Simulation Facility | 1102 | 1802 | 0 |

Note: * = Facility Retained

Facility evaluations indicate comparable capabilities (no mismatches). Thus, the Pt Mugu digital modeling and simulation work (3916 test hours) and the China Lake digital modeling and simulation work (12,065 test hours) were realigned by the optimization model to the highest functional value activity, AFDTC Eglin. This resulted in consolidating 55,305 test hours of workload into one facility with a capacity of 57,820 test hours. The capacity at Pt Mugu and China Lake which can be eliminated is 35,754 test hours which is a 38% reduction in DoD digital simulation and modeling capacity and a 93% reduction in DoD digital simulation and modeling excess capacity.

Since these realignments were performed by the optimization model, there are no adjustments to the optimization model output.

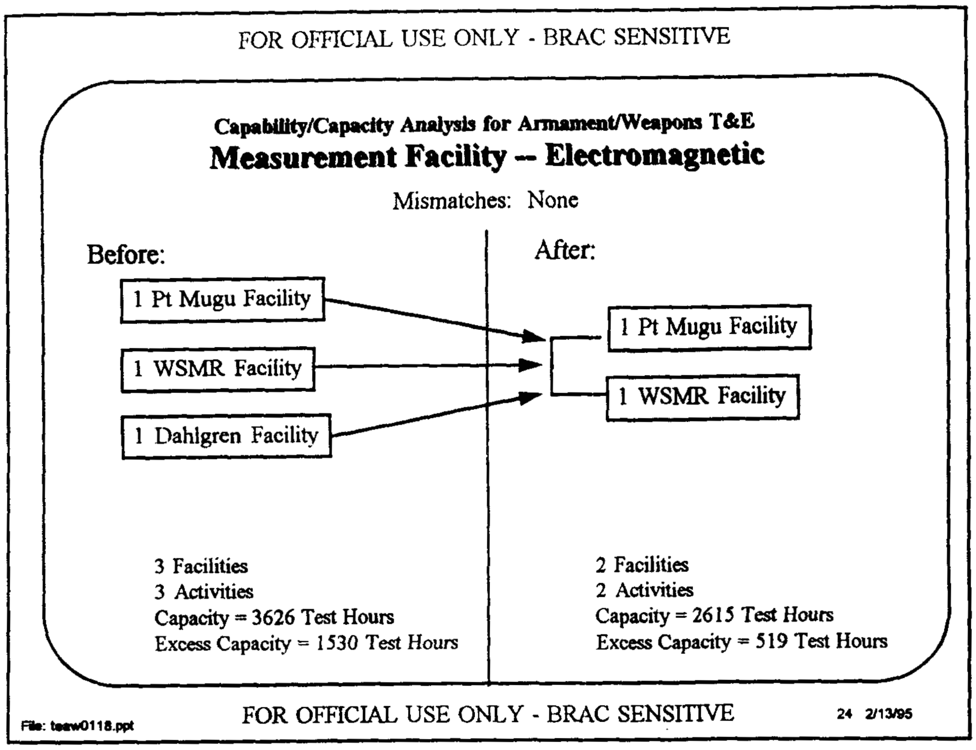



Eleven (11) T&E facilities were categorized in the measurement facility environmental test facility subcategory. The following table lists the eleven (11) facilities with their activity, functional value (FV), projected workload, and capacity and lists the optimization model workload assigned to each activity (Opt Model Asgmt) and the adjustments to the optimization model assignments (Adj Opt Asgmt).

| Activity | FV | Name of Facility | Projected Workload | Capacity | Opt Model Asgmt | Adj Opt Asgmt |
|---|---|---|---|---|---|---|
| Pt Mugu | 77 | | | | 56129 | |
| | | Sea Level Climatic Chamber | 327 | 576 | | 0 |
| | | *Reliability Test Facilities | 1953 | 45376 | | 14528 |
| | | *Ready Missile Test Facility | 12726 | 23301 | | 23301 |
| | | Environmental Test Facility | 1518 | 2800 | | 0 |
| China Lake | 57 | Environmental Test Complex | 21454 | 35419 | 0 | 0 |
| WSMR | 50 | *Applied Environments | 6970 | 18300 | 0 | 18300 |
| YPG | 29 | Environmental Simulation | 127 | 201 | 0 | 0 |
| RTTC | 21 | Non-Destructive/Natural Environment | 4069 | 6302 | 0 | 0 |
| | | Induced Environmental Test | 5680 | 8068 | 0 | 0 |
| Indian Head | 14 | Environmental Test Facility | 1152 | 1600 | 0 | 0 |
| Crane | 13 | Automated Infrared Test Facility | 153 | 360 | 0 | 0 |

Note: * = Facility Retained

The optimization model assigned all measurement facility environmental work to Pt Mugu. However, facility evaluations indicate the Pt Mugu Ready Missile Test Facility and the WSMR Applied Environments Facility offer specialized equipment, configurations, and capabilities. Thus, the WSMR measurement facility environmental workload (6970 test hours) is adjusted back into WSMR, and an additional 11,330 test hours are added to WSMR to reduce the number of facilities. This adjustment reduces two (2) facilities at Pt Mugu and reduces the Pt Mugu measurement facility environmental workload assigned to 37,829 test hours. The number of activities is reduced from seven (7) to two (2), and the number of facilities is reduced from eleven (11) to three (3). The eight (8) realigned facilities reduce DoD capacity by 55,326 test hours which is a 39% reduction in DoD measurement facility environmental capacity and a 64% reduction in DoD measurement facility environmental excess capacity. Environmental testing which requires an aircraft-size chamber can be conducted in the McKinley Climatic Laboratory at AFDTC Eglin which is classified in the Air Vehicle T&E functional area.

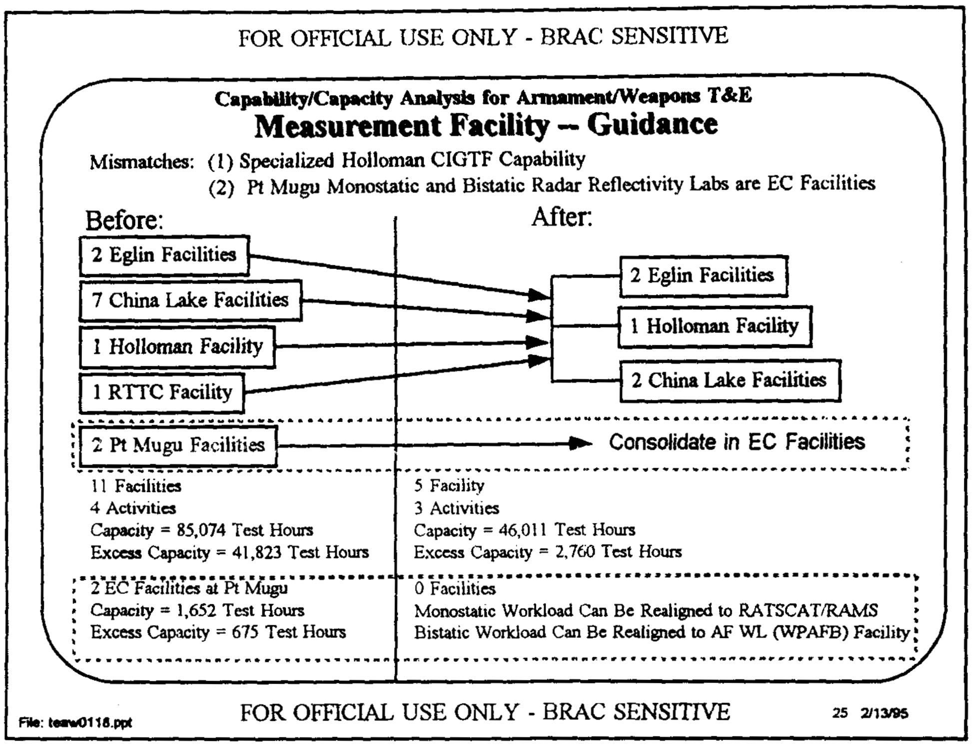



Three (3) T&E facilities were categorized in the measurement facility electromagnetic test facility subcategory. The following table lists the three (3) facilities with their activity, functional value (FV), projected workload, and capacity and lists the optimization model workload assigned to each activity (Opt Model Asgmt) and the adjustments to the optimization model assignments (Adj Opt Asgmt).

| Activity | FV | Name of Facility | Projected Workload | Capacity | Opt Model Asgmt | Adj Opt Asgmt |
|---|---|---|---|---|---|---|
| Pt Mugu | 77 | *Electromagnetic Environmental Effects Laboratory | 774 | 1700 | 1700 | 1181 |
| WSMR | 50 | *Electromagnetic Environment Effects | 638 | 915 | 396 | 915 |
| Dahlgren | 17 | Electromagnetic Vulnerability Assessment Facility | 684 | 1011 | 0 | 0 |

Note: * = Facility Retained

The optimization model filled Pt Mugu's Electromagnetic Environmental Effects Laboratory to capacity and assigned the remaining workload to WSMR. Facility evaluations indicate Dahlgren's workload is comparable to Pt Mugu and WSMR's capabilities; however, enough differences exist to adjust WSMR's 638 test hours back to WSMR and to split the Dahlgren workload between Pt Mugu and WSMR. This results in 1181 test hours at Pt Mugu and 915 test hours at WSMR. The number of activities and facilities are reduced from three (3) to two (2). The one (1) realigned facility reduces DoD capacity by 1011 test hours which is a 28% reduction in DoD measurement facility electromagnetic capacity and a 66% reduction in DoD measurement facility electromagnetic excess capacity.

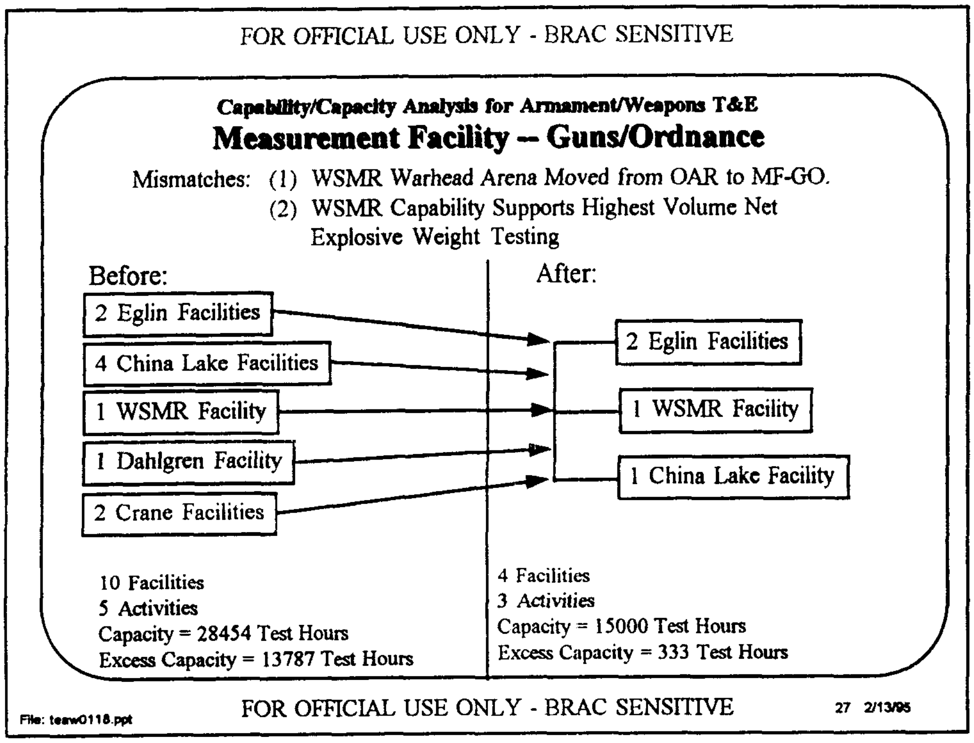



Thirteen (13) T&E facilities were categorized in the measurement facility guidance test facility subcategory. The following table lists the thirteen (13) facilities with their activity, functional value (FV), projected workload, and capacity and lists the optimization model workload assigned to each activity (Opt Model Asgmt) and the adjustments to the optimization model assignments (Adj Opt Asgmt).

| Activity | FV | Name of Facility | Projected Workload | Capacity | Opt Model Asgmt | Adj Opt Asgmt |
|---|---|---|---|---|---|---|
| Eglin | 82 | | | | 14045 | |
| | | *Airborne/Surface Multispectral Signature Measurement Facility | 996 | 2919 | | 2919 |
| | | *Fuze Test Facility | 5356 | 11126 | | 11126 |
| Pt Mugu | 77 | | | | 1652 | |
| | | Monostatic Radar Reflectivity Lab | 464 | 939 | | (EC) 0 |
| | | Bistatic Radar Reflectivity Lab | 513 | 713 | | (EC) 0 |
| China Lake | 57 | | | | 17310 | |
| | | VHF Anechoic Chamber | 130 | 218 | | 0 |
| | | Antiradiation Missile Seeker Test Complex | 708 | 1164 | | 0 |
| | | Foreign Material Exploitation & Balloon Test Complex | 547 | 771 | | 0 |
| | | Guidance Components T&E Complex | 3421 | 4838 | | 0 |
| | | *IR Seeker, GCS DDT&E Complex | 3272 | 4903 | | 4272 |
| | | *RF Seeker/Guidance/Control DDT&E Complex | 2909 | 4063 | | 3909 |
| | | Sensor & Targeting Technology Facility | 964 | 1353 | | 0 |
| Holloman | 30 | *Central Inertial Guidance Test Facility | 4608 | 23000 | 11221 | 21025 |
| RTTC | 21 | Component Test Facility | 20340 | 30719 | 0 | 0 |

Note: * = Facility Retained

The optimization model filled Eglin, Pt Mugu, and China Lake to capacity and assigned additional workload to AFDTC Holloman. Facility evaluations indicate the two (2) Pt Mugu facilities are Electronic Combat T&E facilities versus Armament/Weapons. Therefore, Pt Mugu's workload (977 test hours) and capacity (1652 test hours) are eliminated from further Armament/Weapons T&E analysis. Facility level evaluation also shows Holloman's Central Inertial Guidance Test Facility (CIGTF) to be uniquely capable of performing several types of inertial and guidance tests. These evaluations indicate that RTTC's Component Test Facility workload and China Lake's VHF Anechoic Chamber, Antiradiation Missile Seeker Test Complex, Foreign Material Exploitation & Balloon Test Complex, Guidance Components T&E Complex, and Sensor & Targeting Technology Facility workload could be realigned to AFDTC Eglin's Airborne/Surface Multispectral Signature Measurement Facility and Fuze Test Facility, to AFDTC Holloman's CIGTF, and to China Lake's IR Seeker GCS DDT&E Complex and RF Seeker/Guidance/Control DDT&E Complex. These realignments substantially reduce the number of facilities required to conduct Armament/Weapons testing from eleven (11) to five (5). DoD measurement facility guidance capacity is reduced from 85,074 test hours to 46,011 test hours which is a 46% reduction. Similarly, DoD measurement facility guidance excess capacity is reduced from 41,823 test hours to 2,760 test hours which is a 93% reduction. Again, the two (2) Pt Mugu Electronic Combat T&E facilities were eliminated from Armament/Weapons T&E analysis which decreases the original thirteen (13) T&E facilities to eleven (11). The monostatic workload could be realigned to RATSCAT/RAMS, and the bistatic workload could be realigned to the Air Force Wright Laboratory (Wright-Patterson AFB) in a follow-on analysis.

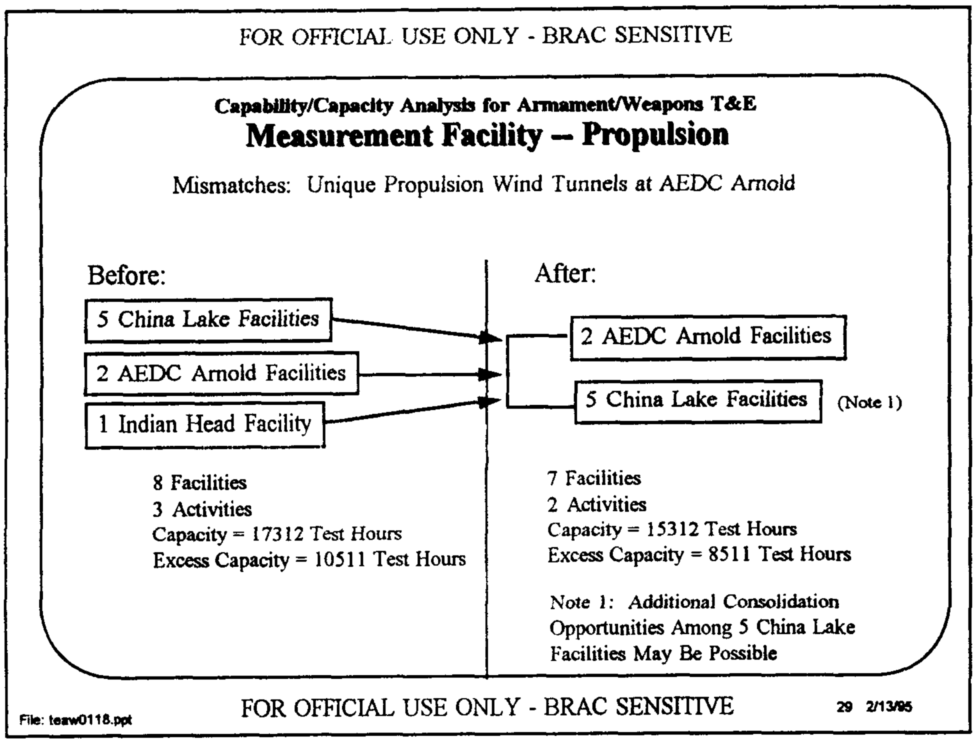



Nine (9) T&E facilities were categorized in the measurement facility guns/ordnance test facility subcategory, and one (1) T&E facility was moved into the subcategory to align comparable test hours. The following table lists the ten (10) facilities with their activity, functional value (FV), projected workload, and capacity and lists the optimization model workload assigned to each activity (Opt Model Asgmt) and the adjustments to the optimization model assignments (Adj Opt Asgmt).

| Activity | FV | Name of Facility | Projected Workload | Capacity | Opt Model Asgmt | Adj Opt Asgmt |
|---|---|---|---|---|---|---|
| Eglin | 82 | | | | 12870 | |
| | | *Warhead Arenas | 1642 | 5505 | | 5505 |
| | | *Gun Test Facility | 3659 | 7365 | | 7365 |
| China Lake | 57 | | | | 1426 | |
| | | Cactus Flats Ordnance Test Area | 1134 | 1575 | | 0 |
| | | *Detonation Physics Laboratory | 734 | 1020 | | 734 |
| | | Medium Caliber Gun & Ammo Ballistics Test Laboratory | 194 | 410 | | 0 |
| | | Ordnance Test Complex | 5674 | 9249 | | 0 |
| WSMR | 50 | *Warhead Test Branch (Note 1) | 371 | 1110 | 0 | 1063 |
| Dahlgren | 17 | Explosive Experimental Area | 270 | 540 | 0 | 0 |
| Crane | 13 | Ordnance Test Area | 737 | 1280 | 0 | 0 |
| | | Transient Velocity Windstream Apparatus | 252 | 400 | 0 | 0 |

Note: * = Facility Retained
(1) WSMR Warhead Test Branch moved from open air range to MF-Guns/Ordnance

Facility evaluations indicate that WSMR's Warhead Test Branch was mis-categorized in the open air range test facility category and should be moved to the measurement facility guns/ordnance subcategory to ensure comparable testing is grouped together. In addition, WSMR's Warhead Test Branch supports the highest volume of net explosive weight testing. Therefore, this facility is maintained. China Lake's Detonation Physics Laboratory is maintained to conduct small size (laboratory scale) detonation tests. These tests could be realigned to Eglin's Wright Laboratory, but were not for the purposes of this T&E analysis. Dahlgren and Crane's arena testing, as well as China Lake's ordnance testing were realigned to AFDTC Eglin and WSMR. China Lake's Medium Caliber Gun/Ammo work was realigned to AFDTC Eglin. The optimization model workload assignments were adjusted to include and maintain WSMR's Warhead Test Branch (371 test hours) and to further realign China Lake's Ordnance workload by deleting 692 additional test hours from China Lake and moving the workload to WSMR. These realignments maintain the specialized WSMR capability and reduce the number of facilities required to support measurement facility guns/ordnance testing. The realignment of six (6) facilities reduces DoD capacity by 13,454 test hours which is a 47% reduction in DoD measurement facility guns/ordnance capacity and a 98% reduction in DoD measurement facility guns/ordnance excess capacity.

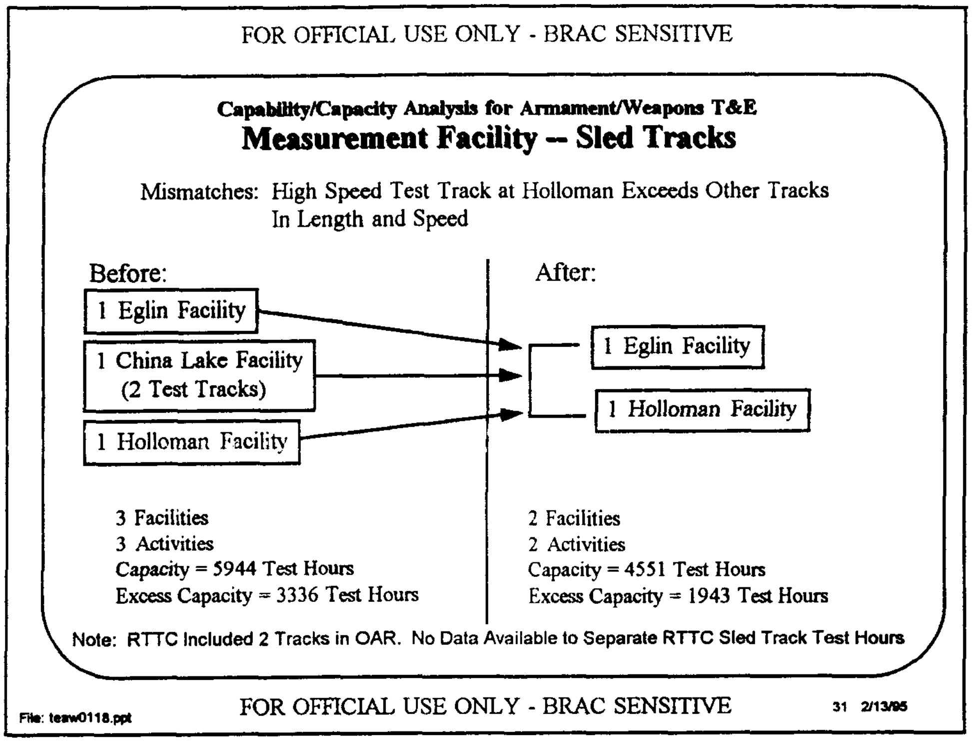



Eight (8) T&E facilities were categorized in the measurement facility propulsion test facility subcategory. The following table lists the eight (8) facilities with their activity, functional value (FV), projected workload, and capacity and lists the optimization model workload assigned to each activity (Opt Model Asgmt) and the adjustments to the optimization model assignments (Adj Opt Asgmt).

| Activity | FV | Name of Facility | Projected Workload | Capacity | Opt Model Asgmt | Adj Opt Asgmt |
|---|---|---|---|---|---|---|
| China Lake | 57 | | | | 6046 | |
| | | *Tactical Propulsion Test Facility | 717 | 1235 | | 1235 |
| | | *Aeroheat Test Facility | 757 | 1191 | | 1037 |
| | | *Air Breathing Propulsion Lab | 230 | 396 | | 230 |
| | | *High Hazard Propulsion Test Facility | 1599 | 2631 | | 1599 |
| | | *Strategic Propulsion Test Complex | 347 | 593 | | 593 |
| Arnold | 30 | | | | 755 | |
| | | *Rocket Propulsion Altitude Test Chamber | 521 | 5496 | | 521 |
| | | *Propulsion Wind Tunnels | 1586 | 3770 | | 1586 |
| Indian Head | 14 | Propulsion Component Test Facility | 1044 | 2000 | 0 | 0 |

Note: * = Facility Retained

The optimization model filled China Lake's capacity and assigned the remaining workload to Arnold. Facility evaluations indicate Arnold's two (2) facilities are unique, and its workload cannot be realigned to China Lake. Therefore, the 2107 test hours are adjusted back to Arnold. The Indian Head workload can be realigned to China Lake, so no further adjustments are required. Facility level analysis did not identify additional consolidation opportunities among China Lake's five (5) propulsion facilities; however, more detailed analysis may show that additional consolidation is possible. The elimination of one (1) facility reduces DoD capacity by 2000 test hours which is a 12% reduction in DoD measurement facility propulsion capacity and a 19% reduction in DoD measurement facility propulsion excess capacity.

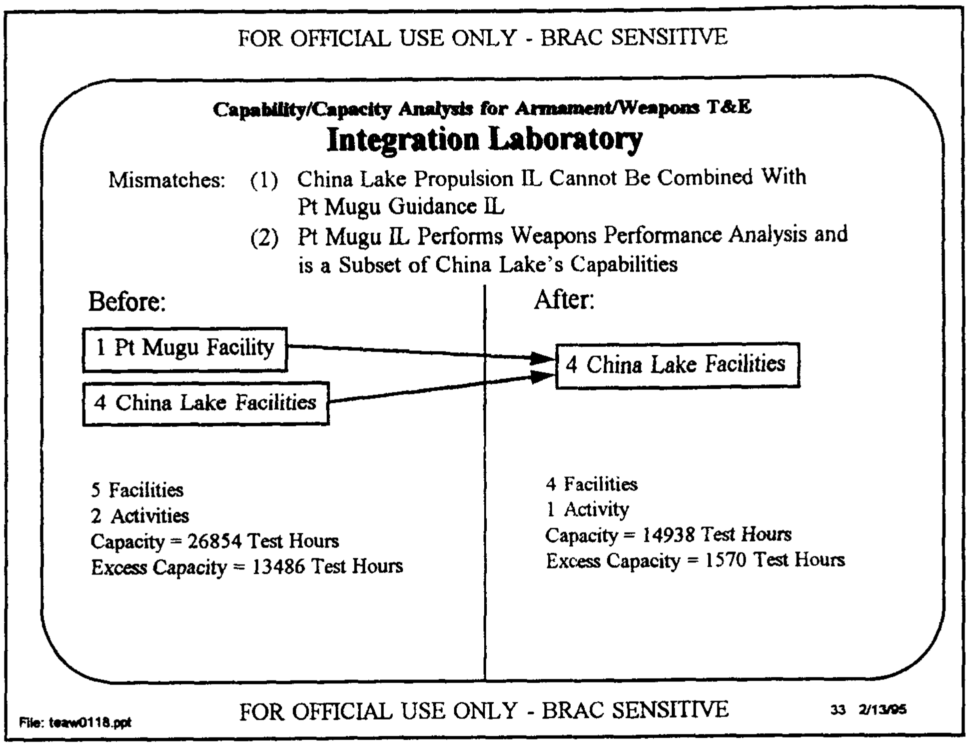



Three (3) T&E facilities were categorized in the measurement facility sled track subcategory. The following table lists the three (3) facilities with their activity, functional value (FV), projected workload, and capacity and lists the optimization model workload assigned to each activity (Opt Model Asgmt) and the adjustments to the optimization model assignments (Adj Opt Asgmt).

| Activity | FV | Name of Facility | Projected Workload | Capacity | Opt Model Asgmt | Adj Opt Asgmt |
|---|---|---|---|---|---|---|
| Eglin | 82 | *Sled Track Facility | 1491 | 3764 | 2608 | 1821 |
| China Lake | 57 | Sled Tracks Facility | 596 | 1393 | 0 | 0 |
| Holloman | 30 | *High Speed Test Track | 521 | 787 | 0 | 787 |

Note: * = Facility Retained

The facility evaluations indicate Holloman's High Speed Test Track significantly exceeds other tracks in length and speed. Thus, workload cannot be realigned from Holloman to Eglin or China Lake. The optimization workload assignments were adjusted to move the 521 test hours out of Eglin and back to Holloman. China Lake's sled track facility includes two (2) tracks, G-4 and SNORT. The G-4 workload is comparable to Eglin's sled track workload and remains realigned to Eglin as assigned by the optimization model. However, the SNORT workload would exceed Eglin's sled track capabilities and must be realigned to Holloman's track. Since China Lake did not report separate test hours or percentages for their two tracks, 266 of the 596 test hours are moved to Holloman to fill its capacity, and the other 330 test hours remain realigned to Eglin. The resulting workload assignments are 1821 test hours at Eglin and 787 test hours at Holloman. Eliminating one (1) facility--two (2) sled tracks--reduces the DoD capacity by 1393 test hours which is a 23% reduction in DoD measurement facility sled track capacity and a 42% reduction in DoD measurement facility sled track excess capacity. Facility evaluations identified two (2) additional sled tracks at Redstone Technical Test Center which were reported as part of the Small Missile open air range. Since data were not available to separate sled track test hours from open air range test hours and since the total Small Missile Range test hours were only 786, these additional sled track test hours remain in the open air range category. If Redstone's sled track test hours could be broken out, they could be realigned to AFDTC Eglin since Eglin's sled track is more capable than Redstone's tracks and Eglin's sled track has 1943 test hours of excess capacity after adjustments to the optimization model workload assignments.

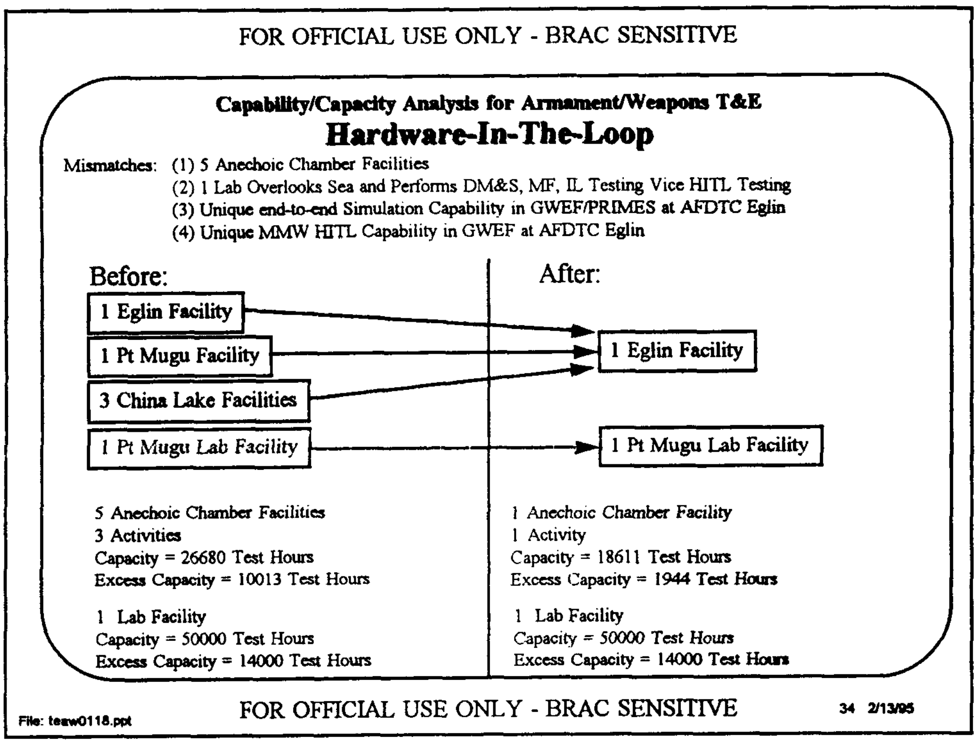



Five (5) T&E facilities were categorized in the integration laboratory test facility category. The following table lists the five (5) facilities with their activity, functional value (FV), projected workload, and capacity and lists the optimization model workload assigned to each activity (Opt Model Asgmt) and the adjustments to the optimization model assignments (Adj Opt Asgmt).

| Activity | FV | Name of Facility | Projected Workload | Capacity | Opt Model Asgmt | Adj Opt Asgmt |
|---|---|---|---|---|---|---|
| Pt Mugu | 77 | Intercept Weapon Evaluation Facility | 5774 | 11916 | 11916 | 0 |
| China Lake | 57 | | | | 1452 | |
| | | *Weapon Guidance/Control/Seeker | 5015 | 9258 | | 9258 |
| | | *Missile/Rocket Motor Assembly | 1042 | 1592 | | 1042 |
| | | *Fuze Development Laboratory | 327 | 538 | | 538 |
| | | *Antiradiation Missile Integration Complex | 1210 | 3550 | | 2530 |

Note: * = Facility Retained

Facility evaluations indicate that China Lake's workload conducted in their Missile/Rocket Motor Assembly Facility, Weapon Guidance/Control/Seeker Facility, Fuze Development Laboratory, and Antiradiation Missile Integration Complex cannot be combined with Pt Mugu's Intercept Weapon Evaluation Facility. Therefore, all the China Lake workload must be adjusted out of Pt Mugu and back to China Lake. However, the Pt Mugu workload is a subset of the China Lake workload. To reduce the number of facilities, Pt Mugu's workload can be realigned to China Lake. The optimization model assignments are adjusted to realign all of Pt Mugu's integration laboratory work into China Lake which results in 13,368 test hours at China Lake. The one (1) facility eliminated reduces DoD capacity by 11,916 test hours which is a 44% reduction in DoD integration laboratory capacity and an 88% reduction in DoD integration laboratory excess capacity.

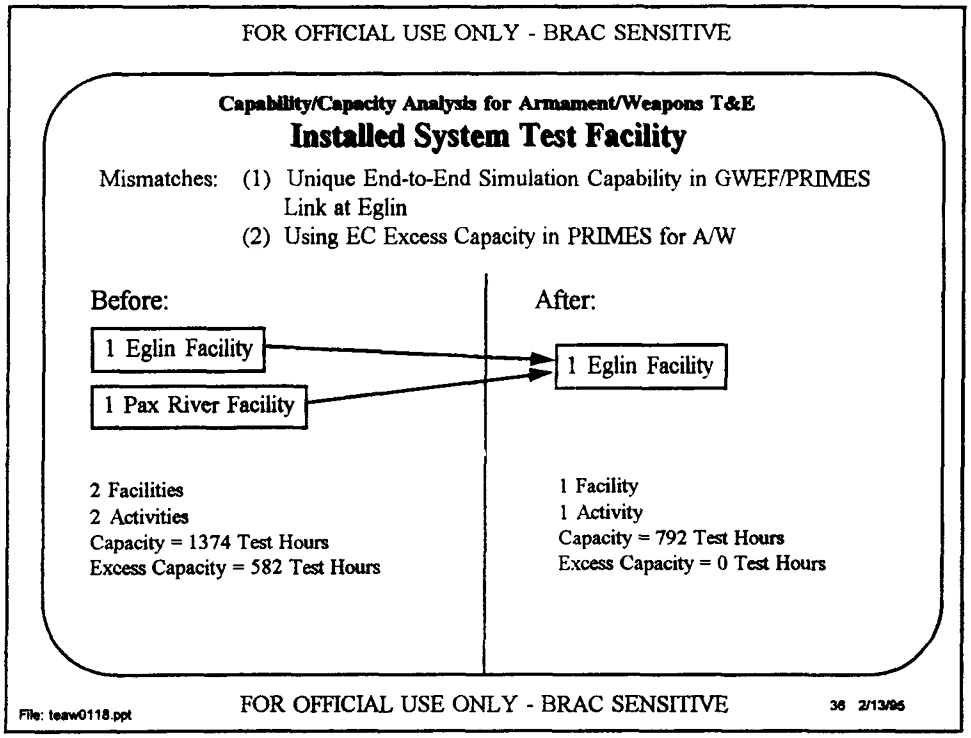



Six (6) T&E facilities were categorized in the hardware-in-the-loop test facility category. Facility level evaluations indicate a mismatch in the Pt Mugu Strike Weapons Evaluation Facility which performs digital modeling and simulation, measurement, and integration testing. This facility does not conduct closed-loop hardware-in-the-loop tests in an anechoic chamber like the other five (5) facilities. Since Pt Mugu did not provide data to facilitate separating the facility test hours into the digital modeling and simulation, measurement facility, and integration laboratory test facility categories, the test hours cannot be reasonably combined with other facilities in these test facility categories. Therefore, Pt Mugu's Strike Weapons Evaluation Facility workload (36,000 test hours) and capacity (50,000 test hours) are kept separate for the remainder of the Armament/Weapons T&E analysis. The following table lists the five (5) hardware-in-the-loop test facilities with their activity, functional value (FV), projected workload, and capacity and lists the optimization model workload assigned to each activity (Opt Model Asgmt) and the adjustments to the optimization model assignments (Adj Opt Asgmt).

| Activity | FV | Name of Facility | Projected Workload | Capacity | Opt Model Asgmt | Adj Opt Asgmt |
|---|---|---|---|---|---|---|
| Eglin | 82 | *Guided Weapons Evaluation Facility (GWEF) | 12085 | 18611 | 18611 | 16667 |
| Pt Mugu | 77 | Missile HITL Facility | 3225 | 4902 | 0 | 0 |
| China Lake | 57 | TSSAM HITL Facility | 233 | 367 | 0 | 0 |
| | | Simulation Lab-Missile HITL | 778 | 1600 | 0 | 0 |
| | | Mk-45 TDD Engineering Development HITL/Test Lab | 346 | 1200 | 0 | 0 |

Note: * = Facility Retained

Facility evaluations identified a unique capability to perform end-to-end (aircraft to missile) hardware-in-the-loop simulations at Eglin using the fiber optic link between the Guided Weapons Evaluation Facility (GWEF) and the Preflight Integration of Munitions and Electronics Systems (PRIMES) Facility. Since the optimization model assigned all hardware-in-the-loop work to Eglin, adjustments were not required to retain this unique capability. The optimization model also assigned part of the Pt Mugu Strike Weapons Evaluation Facility workload (1944 test hours) to Eglin's Guided Weapons Evaluation Facility. These test hours are removed from Eglin and aligned back to Pt Mugu's Strike Weapons Evaluation Facility which is accounted for separately. The adjusted optimization model workload assignment is 16,667 test hours at Eglin with no test hours at the other four (4) facilities. Eliminating four (4) facilities reduces the DoD capacity by 8069 test hours which is a 30% reduction in DoD hardware-in-the-loop capacity and an 81% reduction in DoD hardware-in-the-loop excess capacity.




Two (2) T&E facilities were categorized in the installed system test facility category. The following table lists the two (2) facilities with their activity, functional value (FV), projected workload, and capacity and lists the optimization model workload assigned to each activity (Opt Model Asgmt) and the adjustments to the optimization model assignments (Adj Opt Asgmt).

| Activity | FV | Name of Facility | Projected Workload | Capacity | Opt Model Asgmt | Adj Opt Asgmt |
|---|---|---|---|---|---|---|
| Eglin | 82 | *Preflight Integration of Munitions and Electronics Systems (PRIMES) | 168 | 443+349 =792 | 443 | 792 |
| Pax River | 57 | Air Combat Environment for Test and Evaluation Facility (ACETEF) | 624 | 931 | 349 | 0 |

Note: * = Facility Retained

Facility evaluations identified a unique end-to-end (aircraft to missile) simulation capability at Eglin using the fiber optic link between the Guided Weapons Evaluation Facility and the Preflight Integration of Munitions and Electronics Systems (PRIMES) Facility. Since the optimization model filled Eglin to capacity, adjustments were not required to retain this unique capability. However, an opportunity exists to decrease the number of facilities and to eliminate an activity with only one facility by moving PRIMES Electronic Combat excess capacity (349 test hours) to the Armament/Weapons functional area which increases the capacity to 792 test hours (443 + 349 test hours). By realigning excess capacity across functional areas, the projected workload can be accommodated in the PRIMES facility at Eglin. The elimination of one (1) facility at Pax River also eliminates an Armament/Weapons T&E activity and reduces the DoD capacity by 931 test hours (582 test hours of Armament/Weapons excess capacity + 349 test hours of Electronic Combat excess capacity).

**Capability/Capacity Analysis for Armament/Weapons T&E**

## Adjusted DoD Capacity Baseline (Test Hours)

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| AFDTC Eglin | 82 | 57,820 | 30,679 | | 18,611 | 792 | 16,036 |
| NAWC Pt Mugu | 77 | 8,082 | 73,753 | 11,916 | (1) 4,902 | | 11,609 |
| NAWC China Lake | 57 | 27,672 | 72,422 | 14,938 | 3,167 | | 3,986 |
| NAWC Pax River | 57 | | | | | 931 | |
| WSMR | 50 | | 20,325 | | | | (2) 15,606 |
| AFDTC Holloman | 30 | | 23,787 | | | | |
| YPG | 29 | | 201 | | | | 3,997 |
| NAWC WSMR | 25 | | | | | | 3,925 |
| RTTC | 21 | | 45,089 | | | | 1,188 |
| NSWC Dahlgren | 17 | | 1,551 | | | | |
| AEDC Arnold | 16 | | 9,266 | | | | |
| NSWC Indian Head | 14 | | 3,600 | | | | |
| NSWC Crane | 13 | | 2,040 | | | | |

Note: (1) Plus 50,000 Test Hours (DM&S, MF, IL Testing)
(2) Plus 11,400 Test Hours (DM&S, MF, IL Testing)

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The baseline Armament/Weapons T&E capacity data are adjusted as indicated by boxes around the capacity numbers to reflect the following realignments:

a. The Eglin Preflight Integration of Munitions and Electronics Systems (PRIMES) Facility capacity is increased by 349 test hours ( Electronic Combat excess capacity is moved to Armament/Weapons) which increases Eglin's installed system test facility capacity from 443 test hours to 792 test hours.

b. The Pt Mugu Monostatic and Bistatic Radar Reflectivity Lab capacities are eliminated from the measurement facility guidance subcategory, since the capacities should be aligned with the Electronic Combat functional area. These adjustments are 939 test hours for the Monostatic Radar Reflectivity Lab and 713 test hours for the Bistatic Radar Reflectivity Lab. Together, they reduce Pt Mugu's measurement facility capacity from 75,405 test hours to 73,753 test hours.

c. Pt Mugu's Strike Weapons Evaluation Facility capacity (50,000 test hours) is separated from hardware-in-the-loop test hours. Pt Mugu's hardware-in-the-loop capacity is reduced from 54,902 test hours to 4902 test hours, and the 50,000 test hours are retained separately at the bottom of the chart in Note (1).

d. The WSMR Warhead Test Branch capacity (1110 test hours) is moved from the open air range test facility category to the measurement facility guns/ordnance subcategory. These adjustments increase WSMR's measurement facility capacity from 19,215 test hours to 20,325 test hours and decrease WSMR's open air range workload from 28,116 test hours to 27,006 test hours.

e. The WSMR Materiel Test Facility capacity (11,400 test hours) is separated from open air range test hours which reduces WSMR's open air range capacity from 27,006 test hours to 15,606 test hours. The 11,400 test hours are retained separately at the bottom of the chart in Note (2).

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**Armament/Weapons T&E Baseline**

## Adjusted DoD Workload & Capacity Summary

**(Test Hours/Year)**

| Department | Activities | Facilities | Capacity | Projected Workload | Excess Capacity | % of Excess Capacity |
|---|---|---|---|---|---|---|
| Air Force(1) | 3 | 15 | 156,991 | 79,555 | 77,436 | 29% |
| Navy(2) | 7 | 51 (vs 53) | 294,494 | 145,560 | 148,934 | 55% |
| Army(3) | 3 | 13 | 97,806 | 53,940 | 43,866 | 16% |
| Total | **13** | **79** (vs 81) | 549,291 | 279,055 | **270,236** | 100% |

Notes: (1) Eglin ISTF Capacity Increased by 349 Test Hours
(2) Pt Mugu MF Capacity Decreased by 1652 Test Hours and Workload Decreased by 977 to Eliminate EC Test Hours in 2 Facilities
(3) WSMR MF Capacity Increased by 1110 Test Hours (OAR Capacity Decreased by 1110) and MF Workload Increased by 977 Test Hours (OAR Workload Decreased by 977)

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The previously described adjustments are incorporated into the baseline DoD workload and capacity summary data to generate the adjusted DoD baseline data.

a. The Air Force capacity and excess capacity are increased by 349 test hours (Eglin's PRIMES installed system test facility).
b. The Navy facilities are reduced from fifty-three (53) to fifty-one (51), capacity is decreased by 1652 test hours, workload is decreased by 977 test hours, and excess capacity is decreased by 675 test hours which is the difference between the eliminated facility capacities (1652 test hours) and the eliminated facility workload (977 test hours).
c. The Army summary data remain unchanged, since capacity and workload test hours were moved from the open air range test facility category to the measurement facility guns/ordnance test facility subcategory. No test hours were added or deleted at the summary level.

The adjusted DoD T&E baseline data are thirteen (13) activities, seventy-nine (79) facilities, DoD capacity of 549,291 test hours, DoD projected workload of 279,055 test hours, and DoD excess capacity of 270,236 test hours which remains 49%.

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# Outline

- Armament/Weapons T&E Baseline
- Optimization Model Outputs
- Capability/Capacity Analysis
- → DoD Requirements Analysis
- Alternatives
- Summary

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This section compares the potential facility realignment opportunities to the DoD requirements and T&E Policy Imperatives to ensure consolidation options are valid (feasible) for Military Department consideration and to preserve the T&E capability required to test current and future Armament/Weapons systems.

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DoD Requirements Analysis

## Armament/Weapons T&E

- Realigned DoD Armament/Weapons T&E Structure Must:
  - Meet DoD Weapon System Requirements for Air-to-Air, Air-to-Surface, and Surface-to-Air
  - Meet Policy Imperatives
    - Retain Critical Air/Land/Sea Space
    - Maintain Topographical and Climatic Diversity
    - Support Total Armament/Weapons Test Process
    - Focus Ground Facilities at MRTFB Open Air Ranges
    - Minimize Single Point Failures (to Extent Cost Effective)
  - Provide Capacity to Handle FY2001 Projected Workload
- Therefore, Realign Open Air Ranges First
  - Highest T&E Cost (Approximately 70%)
  - Establish Predominant Gaining Location(s) for T&E Ground Facility Work

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The Armament/Weapons T&E analysis compares the potential facility realignment opportunities generated in the previous section against the five T&E JCSG policy imperatives shown on this chart and against the DoD weapon system requirements for air-to-air, air-to-surface, and surface-to-air. The DoD weapon system requirements were generated by the services in response to a supplemental data call from the T&E JCSG and were provided as certified data. The analysis focuses on realignment of Armament/Weapons open air ranges first, because significant excess capacity exists in this test facility category and the open air range facilities typically have the highest costs. In addition, since T&E JCSG policy directed maximum consolidation to MRTFB activities having an open air range, realignments (gaining activities) of T&E ground facility workload are dependent upon where open air range capabilities are located (after open air range realignments).

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**DoD Requirements Analysis**

## Armament/Weapons T&E

| Open Air Range Requirements (Live Armament/Weapons Launch) | Eglin and WSMR | Sensitivity Analysis: China Lake and WSMR | Sensitivity Analysis: Pt Mugu and WSMR |
|---|---|---|---|
| Airspace: 50,000 sq miles | F | P | F |
| DoD Land Space: 21,000 sq miles | P* | P* | P* |
| Sea Space: 50,000 sq miles | F | NONE | F |
| Max Straight Line (NM): | | | |
| A-A = 220 | F | L | F |
| A-S = 350 | F | L | P |
| S-A = 240 | F | L | F |

AFDTC Eglin and WSMR Best Satisfy DoD Requirements

Note: * = No Activity Meets 21,000 sq mi DoD Land Space Requirement. WSMR's 3, 381 sq mi DoD Land Space is Maximum

F = Meets Requirements, P = Partially Meets Requirements, L = Severe Limitations

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The open air range air, land, and sea space, which is needed to support current and future live weapons safety footprints, is listed on this chart. With the exception of the DoD land space requirement, AFDTC Eglin and White Sands Missile Range (WSMR) fully meet the certified DoD requirements. AFDTC Eglin's air space includes 33,763 square miles of restricted/warning air space, plus an additional 59,380 square miles of Eglin Water Test Areas (EWTA's) which Eglin controls for live weapons testing per agreement with the FAA. AFDTC Eglin's sea space includes 32,618 square miles under warning areas, plus an additional 59,380 square miles under EWTA's. In addition, AFDTC Eglin provides a 478 nautical mile straight line segment within controlled space for live weapons safety footprints which supports air-to-air, air-to-surface, and surface-to-air weapons, including cruise missiles and theater missile defense weapons. Although no Armament/Weapons T&E open air range meets the 21,000 square mile DoD land space requirement, WSMR provides 3381 square miles of DoD land space which is the maximum available DoD land space for weapons testing.

To ensure AFDTC Eglin and WSMR together best satisfy the DoD weapon requirements, a sensitivity analysis was performed using two other range combinations: NAWC China Lake and WSMR, and NAWC Pt Mugu and WSMR. NAWC China Lake's air space is limited to 19,445 square miles, and China Lake does not contain sea space. Further, China Lake's maximum straight line segment within live weapons safety footprints is limited to 60 nautical miles. NAWC Pt Mugu's maximum straight line segment was scored as 300 nautical miles, since Pt Mugu's air space contains five commercial airline routes and two out of five must remain open for commercial airlines traffic (e.g., only three out of five routes can be closed to commercial traffic). The preceding shortfalls with the China Lake/WSMR and Pt Mugu/WSMR combinations confirm that AFDTC Eglin and WSMR are the best combination of ranges to satisfy DoD requirments.

[Note: No Military Operating Areas (MOA's) are included in the above numbers, since live weapons testing cannot be conducted in MOA's.]

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DoD Requirements Analysis

# Armament/Weapons T&E

Sensitivity Analysis

| Capability | | Eglin and WSMR | China Lake and WSMR | Pt Mugu and WSMR |
|---|---|---|---|---|
| Natural Resources: | | | | |
| Critical Space - | Air | F | P | F |
| | Land | F | F | F |
| | Sea | F | | F |
| Topography - | Desert | F | F | F |
| | Mountains | F | F | F |
| | Forest | F | P | P |
| | Swamp | F | | |
| | Riverine | F | | P |
| | Cult Lowland | F | F | F |
| | Sea | F | | F |
| | Littoral | F | | |
| Climate - | Arid | F | F | F |
| | Temperate | F | P | F |
| | Semi-Tropical | F | | |

F = Meets Requirements, P = Partially Meets Requirements, Blank = No Capability

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The combination of AFDTC Eglin and White Sands Missile Range (WSMR) open air ranges meets the T&E JCSG policy imperatives to retain critical air/land/sea space and to maintain topographical and climatic diversity. All types of topography are met, since White Sands Missile Range provides the desert and mountains while AFDTC Eglin provides forest, swamp, riverine, cultivated lowlands, sea, and littoral environments. A diversity of climates is maintained by the AFDTC Eglin/WSMR combination, with WSMR providing the arid and dry temperate climate and Eglin providing the humid temperate and semi-tropical climate. Currently, no Armament/Weapons T&E open air range contains arctic or tropical climates. Deployment to these types of climates, as is done today, will continue.

Again, a sensitivity analysis is performed by evaluating the China Lake/WSMR and the Pt Mugu/WSMR open air range combinations. The China Lake/WSMR range combination does not retain the critical air space, does not contain any sea space, and does not provide a complete spectrum of topography. Instead, the China Lake/WSMR range combination would limit Armament/Weapons testing to arid, desert environments. The Pt Mugu/WSMR range combination does not provide a complete spectrum of topography and does not contain semi-tropical climate. Therefore, the AFDTC Eglin/WSMR open air range combination is the best combination to meet the T&E policy imperative to retain critical air/land/sea space and to maintain topographical and climatic diversity.

**DoD Requirements Analysis**

# Armament/Weapons T&E

**(Cont'd)**

Sensitivity Analysis

| Capability | Eglin and WSMR | China Lake and WSMR | Pt Mugu and WSMR |
|---|---|---|---|
| Technical Resources: | | | |
| DM&S | F | P | P |
| MF | P | P | P |
| IL | Note (1) | F | P |
| HITL | F | P | P |
| ISTF | F | | |
| OAR | F | P | F |

AFDTC Eglin and WSMR Best Satisfy DoD Requirements

Note: (1) A/W Integration Testing Conducted in T&E Support Facilities, PRIMES, GWEF, Gun Test Facility, Fuze Test Facility, etc. vice Separate T&E Facilities

F = Meets Requirements, P = Partially Meets Requirements, Blank = No Capability



The T&E JCSG Policy Imperative to maintain the capability to support the Armament/Weapons test process is evaluated by test facility category on this chart. The AFDTC Eglin and White Sands Missile Range (WSMR) combination fully supports digital modeling and simulation, hardware-in-the-loop, installed system test facility, and open air range weapons test requirements. Integration laboratory testing is conducted in AFDTC Eglin's T&E support facilities, the Preflight Integration of Munitions and Electronics Systems (PRIMES) Facility, the Guided Weapons Evaluation Facility (GWEF), the Gun Test Facility, the Fuze Test Facility, etc., and the WSMR Materiel Test Facility. Due to the diverse types of Armament/Weapons measurement facility testing, more than two activities are needed to fully support the test facility category. Therefore, all combinations of activities are shown partially meeting the measurement facility category.

In comparison, the China Lake/WSMR combination does not provide installed system test facility capabilities; does not provide millimeter wave or complete multi-spectral/multi-mode hardware-in-the-loop capabilities; and does not provide the capability to support safe separation computational fluid dynamics simulations. The Pt Mugu/WSMR combination is similar to the China Lake/WSMR combination except Pt Mugu and WSMR fully meet the open air range technical requirements, but do not provide complete integration laboratory test capabilities. This sensitivity analysis confirms that AFDTC Eglin/WSMR is the best combination to satisfy technical Armament/Weapons test requirements.

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DoD Requirements Analysis for Armament/Weapons T&E

## Capacity Analysis for Open Air Ranges

- Optimization Model Workload Distribution Did Not Satisfy Long-Range, Over-Land Test Requirements

| | | |
|---|---|---|
| AFDTC Eglin | 16,036 | |
| NAWC Pt Mugu | 11,609 | (capability mismatch) |
| NAWC China Lake | 3,986 | (capacity mismatch) |
| WSMR | 111 | |

- Realign Long-Range, Over-Land Test Hours to WSMR (including NAWC WSMR Desert Ship)

| | |
|---|---|
| AFDTC Eglin | 16,036 |
| WSMR | 15,706 |

- Separate (Delete) WSMR Materiel Test Hours (6,246) and Warhead Test Hours (371)

| | | |
|---|---|---|
| AFDTC Eglin | 16,036 | |
| WSMR | 9,089 → | 7,298 National Range<br>1,791 Desert Ship |

- Eglin/WSMR Combined Capacity = 35,567

  FY 2001 Projected Workload = 25,125

  **Excess Capacity= 10,442**

- **Reduction in DoD OAR Excess Capacity = 67%**

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To reiterate the analysis performed in the Capability/Capacity Analysis section, this chart shows the AFDTC Eglin and White Sands Missile Range (WSMR) open air range combination can accommodate the DoD FY2001 projected workload for open air ranges. The chart begins with the optimization model workload assignments and adjusts workload to move the long-range, over-land Armament/Weapons testing out of higher functional value activities and back into WSMR and NAWC WSMR, a tenant at WSMR. The WSMR Warhead Test Branch workload and the WSMR Materiel Test Facility workload is removed to focus on Armament/Weapons open air range testing. The resulting open air range test hours (25,125) can be accommodated by assigning 16,036 test hours to AFDTC Eglin and 9,089 test hours to WSMR. The 9,089 test hours represent 7,298 test hours assigned to WSMR's National Range and 1,791 test hours assigned to NAWC WSMR's Desert Ship Facility.

The Armament/Weapons T&E adjusted baseline open air range capacity of 56,347 test hours is reduced to 35,567 test hours and open air range excess capacity is reduced from 31,222 test hours to 10,442 test hours which represents a 67% reduction in DoD open air range excess capacity.

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DoD Requirements Analysis

## Armament/Weapons T&E

- AFDTC Eglin and WSMR Capabilities
  - Best Combination of Ranges to Meet DoD Requirements
  - Meet all Policy Imperatives
    - Provide Critical Air/Land/Sea Space
    - Only Combination of Ranges Which Provide Complete Topographical and Climatic Diversity
    - Support Armament/Weapons Test Process with Minimum Need for Specialty Activities and Facilities
    - 2 Ranges Eliminate Catastrophic Single Point Failure
  - Consistent with Eglin Scoring Highest A/W Functional Value in T&E JCSG Analysis
  - No Encroachment or Environmental Barriers
- AFDTC Eglin and WSMR Capacity
  - More Than Sufficient to Meet FY2001 Projected Workload
  - DoD OAR Excess Capacity Reduced by 67%

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By directly comparing the AFDTC Eglin and White Sands Missile Range capabilities against the DoD weapon requirements and the T&E JCSG policy imperatives, as well as performing sensitivity analyses, the data show that AFDTC Eglin and White Sands Missile Range are the best combination of activities to satisfy current and future Armament/Weapons system requirements. This finding is consistent with AFDTC Eglin scoring the highest Armament/Weapons functional value in the T&E JCSG analysis. Further, no encroachment or environmental barriers exist, per certified data, to preclude realigning open air range workload into Eglin and White Sands Missile Range. The capacity analysis of Eglin and White Sands Missile Range shows more than sufficient open air range capacity exists on these two ranges to meet the FY2001 projected workload. In addition, these realignments into two ranges substantially reduce the DoD open air range excess capacity.

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# Outline

- Armament/Weapons T&E Baseline
- Optimization Model Outputs
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The facility level capability and capacity analysis of the optimization model outputs, combined with the DoD requirements analysis, provide several realignment options. These alternatives are addressed in the next section.

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## Armament/Weapons T&E Alternatives

- T&E JCSG Alternatives (Non-Core T&E Activities)
- OAR Alternative (Core T&E Activities)
  - Core-1 (A/W)
- Ground Facility Alternative
  - Core-2 (A/W)

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The three categories of Armament/Weapons T&E realignment alternatives are:

a. Realignment of all "non-core" activity test workload into "core" activities. This category covers the T&E JCSG alternatives.
b. Realignment of "core" activity open air ranges to reduce the number of Armament/Weapons open air ranges to the minimum required to meet DoD capability and capacity requirements and T&E JCSG policy imperatives. This realignment alternative is called Core-1(A/W).
c. Realignment of "core" activity ground facilities to reduce the number of Armament/Weapons T&E facilities to the minimum required to meet DoD capability and capacity requirements and to support the Armament/Weapons test process. This realignment alternative is called Core-2(A/W).

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**Armament/Weapons T&E Alternatives**

## JCSG Alternatives

- TE-1 (A/W) Realign Measurement Facility Workload from NSWC Crane
- TE-2 (A/W) Realign Measurement Facility Workload from NSWC Dahlgren
- TE-3 (A/W) Realign Measurement Facility Workload from NSWC Indian Head
- TE-4 (A/W) Realign Measurement Facility and Open Air Range Workload from Redstone Technical Test Center

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The first category of realignments were developed by the T&E JCSG. Per T&E JCSG direction, realignments could only affect "non-core" activities; i.e., no realignments from "core" activities could be proposed. The T&E JCSG generated four alternatives for realigning the four "non-core" Armament/Weapons T&E activities. These "non-core" alternatives realign eleven (11) test facilities. Each alternative listed as potential gaining sites all "core" activities with any test facility in the same test facility category or subcategory as that proposed for realignment.

Alternative TE-1(A/W) recommends realigning the Armament/Weapons environmental and guns/ordnance measurement test work from the Naval Surface Warfare Center at Crane. Alternative TE-2(A/W) recommends realigning the Armament/Weapons electromagnetic and guns/ordnance measurement test work from the Naval Surface Warfare Center at Dahlgren. Alternative TE-3(A/W) recommends realigning the Armament/Weapons environmental and propulsion measurement test work from the Naval Surface Warfare Center at Indian Head. Alternative TE-4(A/W) recommends realigning the Armament/Weapons environmental and guidance measurement test work and the open air range work from Redstone Technical Test Center.

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**Armament/Weapons T&E Alternatives**

# Potential Realignments

| Test Facility Category | Adj Opt Model Facilities | JCSG Alternatives | Comments |
|---|---|---|---|
| Digital Models and Simulations | 7 to 1 | No | |
| MF - Environmental | 11 to 3 | Partial | TE-1,-3,-4 (A/W) |
| MF - Electromagnetic | 3 to 2 | $\boxed{\text{Yes}}$ | TE-2 (A/W) |
| MF - Guidance | 11 to 5 (1) | Limited | TE-4 (A/W) |
| MF - Guns/Ordnance | 10 to 4 | Partial | TE-1,-2 (A/W) |
| MF - Propulsion | 8 to 7 | $\boxed{\text{Yes}}$ | TE-3 (A/W) |
| MF - Sled Tracks | 3 to 2 | No | |
| Integration Laboratory | 5 to 4 | No | |
| Hardware-In-The-Loop | 6 to 2 (2) | No | |
| Installed System Test Facility | 2 to 1 | No | |
| Open Air Range | 13 to 6 (3) | Limited | TE-4 (A/W) |

Note: (1) 2 EC Facilities at Pt Mugu Excluded
(2) Includes 1 Facility at Pt Mugu (DM&S, MF, IL Testing vice HITL)
(3) Includes 1 WSMR Facility (DM&S, MF, IL Testing vice OAR)

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The number and types of test facilities reduced by the T&E JCSG alternatives are compared to the maximum number of facility reductions which were identified in the Capability/Capacity Analysis section. The column titled "adjusted optimization model facilities" shows the maximum reduction in Armament/Weapons test facilities by the test facility categories and subcategories. For example, the digital modeling and simulation test facility category could be reduced from seven (7) Armament/Weapons test facilities to one (1) test facility. The column titled "JCSG alternatives" indicates the amount of reduction achieved by the JCSG alternatives. For example, the measurement facility environmental test facility subcategory was partially reduced by the T&E JCSG alternatives [TE-1(A/W), TE-3(A/W), and TE-4(A/W)]. In this case, three (3) environmental test facilities were realigned; however, there was an opportunity to realign eight (8) test facilities. A "Yes" indicates that all test facility realignment opportunities were covered by the alternative(s) in the "Comments" column. The T&E JCSG alternatives fully realigned two measurement facility subcategories, partially realigned three additional measurement facility subcategories, and realigned a limited amount of open air range test facility category work. On the other hand, the T&E JCSG alternatives did not realign any digital modeling and simulation, sled track, hardware-in-the-loop, or installed system test facility Armament/Weapons T&E work.

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## Armament/Weapons T&E
# JCSG Alternatives

| Alternative | Activity | Functional Value | MF-E | MF-GO | MF-EM | MF-P | MF-G | OAR |
|---|---|---|---|---|---|---|---|---|
| TE-1 (A/W) | - NSWC Crane<br>+ NAWC Pt Mugu | 13<br>77 | <153><br>+153 | | | | | |
| | - NSWC Crane<br>+ AFDTC Eglin | 13<br>82 | | <989><br>+989 | | | | |
| TE-2 (A/W) | - NSWC Dahlgren<br>+ NAWC Pt Mugu | 17<br>77 | | | <684><br>+684 | | | |
| | - NSWC Dahlgren<br>+ AFDTC Eglin | 17<br>82 | | <270><br>+270 | | | | |
| TE-3 (A/W) | - NSWC Indian Head<br>+ NAWC Pt Mugu | 14<br>77 | <1152><br>+1152 | | | | | |
| | - NSWC Indian Head<br>+ NAWC China Lake | 14<br>57 | | | | <1044><br>+1044 | | |

< > = Test Hours Realigned from Activity
\+ = Test Hours Realigned to Activity

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The next two charts indicate where workload could move from (shown by < >) and to (shown by +) if the "non-core" T&E JCSG alternatives are implemented. In each realignment, workload is moved from the "non-core" activity to the "core" activity with the highest functional value and the capability to perform the work. This approach is consistent with the optimization model and the capability/capacity analysis approach. In each case workload is realigned within the test facility category or subcategory. No workload is moved across categories/subcategories.

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## Armament/Weapons T&E
# JCSG Alternatives
### (Cont'd)

| Alternative | Activity | Functional Value | MF-E | MF-GO | MF-EM | MF-P | MF-G | OAR |
|---|---|---|---|---|---|---|---|---|
| TE-4 (A/W) | - RTTC<br>+ NAWC Pt Mugu | 21<br>77 | <9749><br>+9749 | | | | | |
| | - RTTC<br>+ AFDTC Eglin<br>+ NAWC China Lake<br>+ AFDTC Holloman | 21<br>82<br>57<br>30 | | | | | <20340><br>+7690<br>+5350<br>+7300 | |
| | - RTTC<br>+ AFDTC Eglin | 21<br>82 | | | | | | <786><br>+786 |

< > = Test Hours Realigned from Activity
\+ = Test Hours Realigned to Activity

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## JCSG Alternatives

# A/W Workload (Test Hours)

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| AFDTC Eglin | 82 | 39,324 | 22,093 | | 12,085 | 168 | 8,384 |
| NAWC Pt Mugu | 77 | 3,916 | 29,036 | 5,774 | (1)3,225 | | 4,068 |
| NAWC China Lake | 57 | 12,065 | 51,781 | 7,594 | 1,357 | | 2,169 |
| NAWC Pax River | 57 | | | | | 624 | |
| WSMR | 50 | | 7,979 | | | | (2)6,658 |
| AFDTC Holloman | 30 | | 12,429 | | | | |
| YPG | 29 | | 127 | | | | 2,055 |
| NAWC WSMR | 25 | | | | | | 1,791 |
| RTTC | 21 | | 0 | | | | 0 |
| NSWC Dahlgren | 17 | | 0 | | | | |
| AEDC Arnold | 16 | | 2,107 | | | | |
| NSWC Indian Head | 14 | | 0 | | | | |
| NSWC Crane | 13 | | 0 | | | | |

Note: (1) Plus 36,000 Test Hours (DM&S, MF, IL Testing)
(2) Plus 6,246 Test Hours (DM&S, MF, IL Testing)

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The adjusted optimization model outputs (workload assignments) from the Capability/Capacity Analysis section were adjusted to show the results of implementing the T&E JCSG alternatives. Workload assignments are shown by activity with workload separated into the six (6) test facility categories. Boxes around test hours indicate a change in workload assignment from the adjusted optimization model outputs. Zeros indicate an activity currently performs work in this test facility category, and its workload was realigned. Blanks indicate an activity did not submit workload against the test facility category. The results of the T&E JCSG alternatives are four (4) "non-core" Armament/Weapons T&E activities and eleven (11) test facilities are realigned.

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### JCSG Alternatives

## A/W T&E Workload & Capacity Summary (Test Hours/Year)

| Service | Activites | Facilities | Capacity (Test Hours) | Projected Workload (Test Hours) | Excess Capacity (Test Hours) | % Reduction in Excess Capacity |
|---|---|---|---|---|---|---|
| Air Force | 3 | 15 | 156,991 | 96,590 | 60,401 | 22% |
| Navy | 4 | 44 | 287,303 | 159,400 | 127,903 | 14% |
| Army | 2 | 9 | 51,529 | 23,065 | 28,464 | 35% |
| Total | **9** (vs 13) | **68** (vs 79) | 495,823 | 279,055 | **216,768** | |
| **Reduction from Baseline** | 31% | 14% | 10% | -- | 20% | |

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Implementing the T&E JCSG alternatives reduces the number of Armament/Weapons T&E activities from thirteen (13) to nine (9) which is a 31% reduction, reduces the number of facilities from seventy-nine (79) to sixty-eight (68) which is a 14% reduction, reduces DoD capacity from 549,291 to 495,823 which is a 10% reduction, and reduces DoD excess capacity from 270,236 to 216,768 which is a 20% reduction.

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### JCSG Alternatives

## Armament Weapons T&E

- Realigns 4 Non-Core Activities (Out of 13 Total)
  - Vice 6 Core and Non-Core Activities in Adjusted Optimization Model Output
- Realigns 11 Facilities (Out of 79)
  - Vice 42 in Adjusted Optimization Model Output
- Reduces Excess Capacity by 20%
  - Vice 70% in Adjusted Optimization Model Output

**Additional Realignment Opportunities Exist**

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Although the T&E JCSG alternatives realign four (4) "non-core" Armament/Weapons activities and eleven (11) test facilities, the optimization model output and Capability/Capacity Analysis section identified the opportunity to realign six (6) activities and forty-two (42) test facilities. Similarly, the T&E JCSG alternatives reduce the DoD Armament/Weapons T&E excess capacity by 20%; however, there is an opportunity to reduce the excess capacity by 70%. Because the T&E JCSG alternatives for "non-core" activities fall short of the potential reductions to the Armament/Weapons T&E infrastructure, there are significant additional realignment opportunities which could be implemented for "core" activities.



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## Armament/Weapons T&E Alternatives
## Core-1 (A/W)

- Realign Open Air Range Armament/Weapons T&E from NAWC Pt Mugu, NAWC China Lake, and YPG to AFDTC Eglin and WSMR

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The T&E JCSG alternative TE-4(A/W) recommended realigning the Small Missile Range open air testing at Redstone Technical Test Center, a "non-core" activity. This realignment reduces only 1188 test hours of DoD Armament/Weapons open air range capacity. Significant additional excess capacity remains at the "core" activities in Armament/Weapons open air ranges, the most expensive test facility category to build, operate and maintain, To significantly reduce the DoD excess capacity and costs associated with Armament/Weapons open air ranges, core alternative 1 (A/W) recommends realigning open air range Armament/Weapons T&E from NAWC Pt Mugu, NAWC China Lake, and Yuma Proving Ground to AFDTC Eglin and White Sands Missile Range.


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## Armament/Weapons T&E Alternatives
# Potential Realignments

| Test Facility Category | Adj Opt Model Facilities | JCSG Alternatives | JCSG Plus Core-1 (A/W) | Comments |
|---|---|---|---|---|
| Digital Models and Simulations | 7 to 1 | No | No | |
| MF - Environmental | 11 to 3 | Partial | Partial | TE-1,3,4 (A/W) |
| MF - Electromagnetic | 3 to 2 | Yes | Yes | TE-2 (A/W) |
| MF - Guidance | 11 to 5 (1) | Limited | Limited | TE-4 (A/W) |
| MF - Guns/Ordnance | 10 to 4 | Partial | Partial | TE-1,2 (A/W) |
| MF - Propulsion | 8 to 7 | Yes | Yes | TE-3 (A/W) |
| MF - Sled Tracks | 3 to 2 | No | No | |
| Integration Laboratory | 5 to 4 | No | No | |
| Hardware-In-The-Loop | 6 to 2 (2) | No | No | |
| Installed System Test Facility | 2 to 1 | No | No | |
| Open-Air-Range | 13 to 6 (3) | Limited | Yes | Core-1, TE-4 (A/W) |

Note: (1) 2 EC Facilities at Pt Mugu Excluded
(2) Includes 1 Facility at Pt Mugu (DM&S, MF, IL Testing vice HITL)
(3) Includes 1 WSMR Facility (DM&S, MF, IL Testing vice OAR)

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By realigning "core" activity open air ranges, in addition to the "non-core" T&E JCSG alternatives, the maximum reduction is achieved in Armament/Weapons open air ranges. This is shown in the column titled "JCSG Plus Core-1(A/W)". Thirteen (13) baseline open air range test facilities are reduced to six (6) test facilities. One (1) test facility was reduced by the "non-core" T&E JCSG alternatives, and six (6) additional "core" test facilities are reduced by Core-1(A/W). Six (6) ranges are reduced to two (2) ranges, AFDTC Eglin and White Sands Missile Range. One (1) Armament/Weapons "non-core" range at Redstone Technical Test Center was reduced by the T&E JCSG alternatives, and three (3) additional "core" ranges (NAWC Pt Mugu, NAWC China Lake, and Yuma Proving Ground) are reduced by Core-1(A/W). The ground test facility realignments, which are also shown in the column titled "JCSG Plus Core-1(A/W)", are all associated with the "non-core" T&E JCSG alternatives.

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**Armament/Weapons T&E Alternatives**

## Core-1 (A/W)

- Scenario:
  - Consolidate A/W Open Air Range T&E to AFDTC Eglin and WSMR
- Concept of Operations
  - Establish Navy Detachment at Eglin
  - Rebase Navy Test Aircraft, Aircrews, and Maintenance Personnel at Eglin
  - (Optional) Relocate Navy Test Planners /Engineers at Eglin to Support Navy A/W Open Air Testing
  - Use Existing Eglin Hangars, Ramps, Runways and Office Space to House Navy Personnel and Test Aircraft
  - Hire Additional Range Support Contractors at Eglin

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The scenario and concept of operations for alternative Core-1(A/W) are shown on this chart. A Navy detachment at Eglin, similar to the Army's AQTD Edwards detachment, is proposed to facilitate Navy use of the Eglin open air range. Existing hangars, ramps, runways and office space could be used to rebase Navy test aircraft and to accommodate Navy aircrews, maintenance personnel, and test planners/engineers. The existing core of Eglin test and range personnel would be supplemented by additional range support contractors, as required to meet the additional test workload.

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Armament/Weapons T&E Alternatives

## Core-1 (A/W)

- Rationale:
  - Reduces Number of A/W T&E Open Air Ranges to 2
  - Reduces Number of A/W OAR Facilities to 6
  - Reduces DoD OAR Capacity by 37%
  - Reduces DoD OAR Excess Capacity by 67%
  - Addresses Approximately 70% of Total T&E Costs

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The rationale for consolidating "core" Armament/Weapons open air ranges to the minimum number required (AFDTC Eglin and White Sands Missile Range) is to substantially reduce DoD costs (and DoD excess capacity) by focusing on the most expensive test facility category in Armament/Weapons T&E. (See Appendix C.)

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Armament/Weapons T&E Alternatives

## Core-1 (A/W) and JCSG Alternatives

### Workload and Capacity Summary (Test Hours/Year)

| Service | Activites | Facilities | Capacity (Test Hours) | Projected Workload (Test Hours) | Excess Capacity (Test Hours) | % Reduction in Excess Capacity |
|---|---|---|---|---|---|---|
| Air Force | 3 | 15 | 156,991 | 104,242 | 52,749 | 32% |
| Navy | 4 | 41 | 271,708 | 153,163 | 118,545 | 20% |
| Army | 2 | 6 | 47,532 | 21,650 | 25,882 | 41% |
| Total | **9** (vs 13) | **62** (vs 79) | 476,231 | 279,055 | **197,176** | |
| % Reduction from Baseline | 31% | 22% | 13% | -- | 27% | |

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Implementing the Core-1 (A/W) alternative, in addition to the "non-core" T&E JCSG alternatives, reduces the number of Armament/Weapons test facilities from the adjusted baseline of seventy-nine (79) facilities to sixty-two (62) facilities. This is a reduction of six (6) additional test facilities from the sixty-eight (68) facilities which remain after implementing the T&E JCSG alternatives. DoD Armament/Weapons T&E capacity is reduced by 13% (vice 10% after implementing the T&E JCSG alternatives) and DoD excess capacity is reduced by 27% (vice 20% after implementing the "non-core" T&E JCSG alternatives). Although the reduction in DoD Armament/Weapons T&E capacity and excess capacity, which is solely attributed to alternative Core-1 (A/W), is not large in comparison with the total numbers, the potential DoD cost reductions are very high.

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Armament/Weapons T&E Alternatives

## Core-1 (A/W) and JCSG Alternatives
## Workload (Test Hours)

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| AFDTC Eglin | 82 | 39,324 | 22,093 | | 12,085 | 168 | 16,036 |
| NAWC Pt Mugu | 77 | 3,916 | 29,036 | 5,774 | (1) 3,225 | | 0 |
| NAWC China Lake | 57 | 12,065 | 51,781 | 7,594 | 1,357 | | 0 |
| NAWC Pax River | 57 | | | | | 624 | |
| WSMR | 50 | | 7,979 | | | | (2) 7,298 |
| AFDTC Holloman | 30 | | 12,429 | | | | |
| YPG | 29 | | 127 | | | | 0 |
| NAWC WSMR | 25 | | | | | | 1,791 |
| AEDC Arnold | 16 | | 2,107 | | | | |

Note: (1) Plus 36,000 Test Hours (DM&S, MF, IL Testing)
(2) Plus 6,246 Test Hours (DM&S, MF, IL Testing)

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The workload assignments, which resulted from implementing the "non-core" T&E JCSG alternatives, are adjusted to show the results of consolidating "core" open air ranges [i.e., Alternative Core-1(A/W)]. NAWC Pt Mugu, NAWC China Lake, and Yuma Proving Ground open air ranges are realigned to AFDTC Eglin and White Sands Missile Range. Realigning these three "core" ranges reduces six (6) additional test facilities. As in previous charts, workload assignments are shown by activity with workload separated into the six (6) test facility categories. Boxes around the test hours indicate a change in workload assignment from the workload which resulted from implementing the "non-core" T&E JCSG alternatives. Zeros indicate an activity currently performs work in this test facility category, and its workload was realigned. Blanks indicate an activity did not submit workload against the test facility category.

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**Armament/Weapons T&E Alternatives**

## Core-2 (A/W)

- Realign Ground Facility Armament/Weapons T&E to AFDTC Eglin. Maintain Capability to Support Specialized Testing at WSMR, NAWC China Lake, AFDTC Holloman, and AEDC Arnold.

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The number of Armament/Weapons T&E activities and facilities and the amount of DoD excess capacity, which remain after implementing the "non-core" T&E JCSG alternatives and the Core-1(A/W) alternative, are still large due to the significant amount of DoD Armament/Weapons ground test facility duplication among the "core" activities. Alternative Core-2(A/W) proposes to realign Armament/Weapons ground test facilities predominately to AFDTC Eglin, in accordance with AFDTC's highest functional value among all DoD Armament/Weapons T&E activities. Other realignments are proposed to maintain, and increase the amount of ground test facility workload at, four (4) additional Armament/Weapons T&E activities (White Sands Missile Range, NAWC China Lake, AFDTC Holloman, and AEDC Arnold).

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## Armament/Weapons T&E Alternatives
# Potential Realignments

| Test Facility Category | Adj Opt Model Facilities | JCSG Alternatives | JCSG Plus Core-1 (A/W) | JCSG Plus Core-1 & Core-2 (A/W) |
|---|---|---|---|---|
| Digital Models and Simulations | 7 to 1 | No | No | Yes |
| MF - Environmental | 11 to 3 | Partial | Partial | Yes |
| MF - Electromagnetic | 3 to 2 | Yes | Yes | Yes |
| MF - Guidance | 11 to 5 (1) | Limited | Limited | Yes |
| MF - Guns/Ordnance | 10 to 4 | Partial | Partial | Yes |
| MF - Propulsion | 8 to 7 | Yes | Yes | Yes |
| MF - Sled Tracks | 3 to 2 | No | No | Yes |
| Integration Laboratory | 5 to 4 | No | No | Yes |
| Hardware-In-The-Loop | 6 to 2 (2) | No | No | Yes |
| Installed System Test Facility | 2 to 1 | No | No | Yes |
| Open-Air-Range | 13 to 6 (3) | Limited | Yes | Yes |

Note: (1) 2 EC Facilities at Pt Mugu Excluded
(2) Includes 1 Facility at Pt Mugu (DM&S, MF, IL Testing vice HITL)
(3) Includes 1 WSMR Facility (DM&S, MF, IL Testing vice OAR)

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By realigning "core" activity ground test facilities, in additional to the "non-core" T&E JCSG alternatives and the Core-1(A/W) alternative, maximum reductions are achieved in all Armament/Weapons test facility categories and subcategories. This is shown in the column titled "JCSG plus Core-1 & Core-2(A/W)". The "Yes" in each category/subcategory indicates the facility reductions shown in the column titled "Adj Opt Model Facilities" are now accounted for by the "non-core" T&E JCSG alternatives, the Core-1(A/W) alternative, and the Core-2(A/W) alternative.

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Armament/Weapons T&E Alternatives

## Core-2 (A/W)

- Scenario:
  - Consolidate Ground Facility A/W T&E Workload into 31 Facilities
  - Maximize Use of AFDTC Eglin to Take Advantage of Most Capable (highest FV) Activity
    - DM&S Testing
    - Measurement Testing
    - HITL Testing
    - ISTF Testing
  - Maintain Specialized Testing at
    - WSMR (Measurement Testing)
    - NAWC China Lake (Measurement and Integration Testing)
    - AFDTC Holloman (Measurement Testing)
    - AEDC Arnold (Measurement Testing)

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The scenario for alternative Core-2(A/W) is shown on this chart. The Armament/Weapons ground test workload is consolidated into thirty-one (31) test facilities versus the sixty-six (66) ground test facilities shown in the adjusted baseline data. To take advantage of the highest functional value Armament/Weapons T&E activity, all ground test workload in the following categories is realigned into Eglin's test facilities:

a. Digital modeling and simulation testing
b. Hardware-in-the-loop testing
c. Installed systems testing

Measurement testing is consolidated into five (5) Armament/Weapons T&E activities (AFDTC Eglin, White Sands Missile Range, NAWC China Lake, AFDTC Holloman, and AEDC Arnold), and integration testing is consolidated into one (1) activity (NAWC China Lake).

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Armament/Weapons T&E Alternatives

## Core-2 (A/W)

- Concept of Operations
  - (Optional) Relocate Navy Test Engineers at Eglin to Support Navy A/W Ground Facility T&E
  - Use Existing Core of Facility Engineers at Eglin
  - Hire Additional Support Contractors at Eglin to Meet Increased Ground Facility Workload As Required
  - Move Pt Mugu Measurement Facilities to China Lake
  - Management Transfer Pt Mugu Strike Weapons Evaluation Facility to China Lake

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The concept of operations builds on the Core-1 (A/W) concept of establishing a Navy detachment at Eglin. Eglin's existing core of facility engineers would be supplemented by hiring additional support contractors, as required, to meet the increased Armament/Weapons ground test facility workload. If desired by the Navy, Navy test engineers could be relocated to Eglin to support the Navy's Armament/Weapons ground testing.

Since NAWC Pt Mugu Armament/Weapons test facilities are reduced to four (4), the following three (3) ground test facilities are moved (relocated) to China Lake to reduce the number of Armament/Weapons T&E activities:

a. Ready Missile Test Facility
b. Reliability Test Facilities
c. Electromagnetic Environmental Effects Laboratory

The fourth Pt Mugu test facility, Strike Weapons Evaluation Facility, cannot be completely relocated to China Lake and retain its capability to collect seeker/sensor data tracking aircraft which are flying over the Pacific Ocean inner sea test range; therefore, it is management transferred to China Lake. A similar capability exists at AFDTC Eglin in the Airborne/Surface Multispectral Signature Measurement Facility. However, over-water seeker/sensor data are collected dynamically using a pod mounted on a test aircraft or using a modified C-130 with turret mounted seekers/sensors. Static (non-dynamic) testing can be conducted in the Guided Weapons Evaluation Facility (GWEF) at Eglin; however, this capability does not overlook the Gulf. Since a direct capability match was not available and the projected workload is high (36,000 test hours), the facility is assumed to be cantoned.

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Armament/Weapons T&E Alternatives

## Core-2 (A/W)

- Rationale:
  - Reduces Number of Ground Facility Activities to 5
    - AFDTC Eglin
    - WSMR
    - NAWC China Lake
    - AFDTC Holloman
    - AEDC Arnold
  - Reduces Number of Ground Facilities to 31
  - Accomplishes All Optimization Model Realignment Opportunities

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The rationale for the Core-2(A/W) alternative is to substantially reduce the number of Armament/Weapons ground test facilities to thirty-one(31) and to reduce the number of activities providing Armament/Weapons ground testing to five (5) as shown on this chart. These realignments finish reducing the Armament/Weapons T&E infrastructure to the minimum level which can support current and future weapon system T&E.

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Armament/Weapons T&E Alternatives

## Core-2 (A/W)

- Impacts Navy and Army Synergy With
  - R&D
  - Surface-To-Surface T&E

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Since the Naval Warfare Center concept includes research and development (R&D) and test and evaluation (T&E) integrated into many of the same ground facilities, realignment of Navy Armament/Weapons T&E workload from their ground test facilities would impact the synergy with Navy R&D work. In addition, many of the Navy and Army ground test facilities also support surface-to-surface T&E. Realignment of Armament/Weapons T&E workload from these ground facilities would impact synergy with Navy and Army surface-to-surface testing.

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Armament/Weapons T&E Alternatives

## Core-1/2 (A/W) and JCSG Alternatives DoD Facility Relocations

| Test Facility Category | AFDTC Eglin | NAWC Pt Mugu | NAWC China Lake | WSMR (1) | AFDTC Holloman | AEDC Arnold | DoD Total |
|---|---|---|---|---|---|---|---|
| DM&S | 1 | | | | | | 1 |
| MF - Environmental | | 2 → Move | | 1 | | | 3 |
| MF - Electromagnetic | | 1 → Move | | 1 | | | 2 |
| MF - Guidance | 2 | | 2 | | 1 | | 5 |
| MF - Guns/Ordnance | 2 | | 1 | 1 (2) | | | 4 |
| MF - Propulsion | | | 5 | | | 2 | 7 |
| MF - Sled Tracks | 1 | | | | 1 | | 2 |
| Integration Laboratory | | | 4 | | | | 4 |
| Hardware-In-The-Loop | 1 | 1 (3) → Mgmt Transfer | | | | | 2 |
| Installed Sys Test Fac | 1 | | | | | | 1 |
| Open Air Range | 1 Range = 3 Fac | | | 1 Range = 3 Fac | | | 2 Range = 6 Fac |

Note: (1) WSMR Includes NAWC-WSMR Desert Ship Facility
(2) WSMR Warhead Arena Facility
(3) Pt Mugu Strike Weapons Evaluation Facility is DMS, MF, & IL vice HITL

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This chart identifies the location of the thirty-seven (37) Armament/Weapons T&E facilities and shows the proposed reduction of NAWC Pt Mugu as an Armament/Weapons T&E activity by moving and management transferring Pt Mugu ground test facilities to NAWC China Lake.



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Armament/Weapons T&E Alternatives

# Core-1/2 (A/W) and JCSG Alternatives DoD Facility Summary

| Test Facility Category | AFDTC Eglin | NAWC China Lake | WSMR (1) | AFDTC Holloman | AEDC Arnold | DoD Total |
|---|---|---|---|---|---|---|
| DM&S | 1 | | | | | 1 |
| MF - Environmental | | 2 | 1 | | | 3 |
| MF - Electromagnetic | | 1 | 1 | | | 2 |
| MF - Guidance | 2 | 2 | | 1 | | 5 |
| MF - Guns/Ordnance | 2 | 1 | 1 (2) | | | 4 |
| MF - Propulsion | | 5 | | | 2 | 7 |
| MF - Sled Tracks | 1 | | | 1 | | 2 |
| Integration Laboratory | | 4 | | | | 4 |
| Hardware-In-The-Loop | 1 | 1 (3) | | | | 2 |
| Installed Sys Test Fac | 1 | | | | | 1 |
| Open Air Range | 1 Range = 3 Fac | | 1 Range = 3 Fac | | | 2 Range = 6 Fac |

Note: (1) WSMR Includes NAWC-WSMR Desert Ship Facility
(2) WSMR Warhead Arena Facility
(3) Pt Mugu Strike Weapons Evaluation Facility is DMS, MF, & IL vice HITL

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By realigning the workload from "non-core" activities (T&E JCSG Alternatives) and reducing the duplication of Armament/Weapons test facilities at "core" activities [Core-1 and -2(A/W)], the Armament/Weapons T&E infrastructure is significantly reduced. The thirty-seven (37).test facilities are located at six (6) activities within five (5) installations.

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Armament/Weapons T&E Alternatives

**Core-1/2 (A/W) and JCSG Alternatives Workload (Test Hours)**

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| AFDTC Eglin | 82 | 55,305 | 28,736 | | 16,667 | 792 | 16,036 |
| NAWC Pt Mugu | 77 | 0 | 0 | 0 | 0 | | |
| NAWC China Lake | 57 | 0 | 52,619 | 13,368 | (1) 0 | | |
| NAWC Pax River | 57 | | | | | 0 | |
| WSMR | 50 | | 20,278 | | | | (2) 7,298 |
| AFDTC Holloman | 30 | | 21,812 | | | | |
| YPG | 29 | | 0 | | | | |
| NAWC WSMR | 25 | | | | | | 1,791 |
| AEDC Arnold | 16 | | 2,107 | | | | |

Note: (1) Plus 36,000 Test Hours (DM&S, MF, IL Testing)
(2) Plus 6,246 Test Hours (DM&S, MF, IL Testing)

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The workload assignments, which resulted from implementing the Core-1(A/W) alternative, are adjusted to show the results of consolidating "core" ground test facilities [i.e., Alternative Core-2(A/W)]. Digital modeling and simulation, hardware-in-the-loop, and installed system test facility workload is realigned to AFDTC Eglin. Integration laboratory workload is realigned to NAWC China Lake, and measurement facility workload is consolidated into the fewest number of facilities required to support Armament/Weapons T&E. The activities previously realigned by the "non-core" T&E JCSG alternatives are not shown on this chart, since no Armament/Weapons T&E remains at these activities. Again, boxes around the test hours indicate changes in workload assignments from the results of implementing the Core-1(A/W) alternative. Zeros indicate an activity currently performs work in this test facility category, and its workload was realigned. Blanks indicate an activity did not submit workload against the test facility category.

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Armament/Weapons T&E Alternatives

## Core-1/2 (A/W) and JCSG Alternatives Workload and Capacity Summary (Test Hours/Year)

| Service | Activites | Facilities | Capacity (Test Hours) | Projected Workload (Test Hours) | Excess Capacity (Test Hours) | % Reduction in Excess Capacity |
|---|---|---|---|---|---|---|
| Air Force | 3 | 15 | 156,991 | 141,455 | 15,536 | 80% |
| Navy | 2 | 17 | 155,272 | 103,778 | 51,494 | 65% |
| Army | 1 | 5 | 47,331 | 33,822 | 13,509 | 69% |
| Total | **6** (vs 13) | **37** (vs 79) | 359,594 | 279,055 | **80,539** | |
| Reduction from Baseline | 54% | 53% | 35% | -- | 70% | |

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Implementing the Core-2(A/W) alternative, in addition to the Core-1(A/W) and "non-core" T&E JCSG alternatives, reduces the number of Armament/Weapons test facilities from the adjusted baseline of seventy-nine (79) facilities to thirty-seven (37) facilities. This is a reduction of twenty-five (25) additional test facilities from the sixty-two (62) facilities which remain after implementing the Core-1(A/W) alternative. DoD Armament/Weapons T&E capacity is reduced by 35% (vice 13% after implementing the Core-1(A/W) alternative) and DoD excess capacity is reduced by 70% (vice 27% after implementing the Core-1(A/W) alternative). These realignments represent the maximum achievable reduction in Armament/Weapons T&E infrastructure.

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# Outline

- Armament/Weapons T&E Baseline
- Optimization Model Outputs
- Capability/Capacity Analysis
- DoD Requirements Analysis
- Alternatives
- Summary

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The following charts summarize the results of completing the T&E JCSG Analysis Plan for "core" T&E activities for the Armament/Weapons T&E functional area.

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# Summary
# Armament/Weapons T&E

| Options | Activities | Facilities | DoD Capacity (Test Hours) | DoD Excess Capacity (Test Hours) | Comments |
|---|---|---|---|---|---|
| Baseline (Adjusted) | 13 | 79 | 549,291 | 270,236 | |
| Non-Core (JCSG) Alternatives | 9 <31%> | 68 <14%> | 495,823 <10%> | 216,768 <20%> | Non-Core Realigned |
| Core-1 (A/W) OAR Realignment | 9 <31%> | 62 <22%> | 476,231 <13%> | 197,176 <27%> | Non-Core Realigned Plus MRTFB OAR Consolidation |
| Core-2 (A/W) Ground Facility Realignment * | 6 <54%> | 37 <53%> | 359,594 <35%> | 80,539 <70%> | Core and Non-Core Realigned |

* Maximum Reductions Achievable     < > = % Reduction

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The adjusted Armament/Weapons T&E baseline contains thirteen (13) activities and seventy-nine (79) test facilities broken out as follows:

a. Air Force: 3 activities, 15 facilities
b. Navy: 7 activities, 51 facilities
c. Army: 3 activities, 13 facilities

Implementing the "non-core" T&E JCSG alternatives will reduce the number of activities by (4) and the number of facilities by eleven (11). These reductions result in a 31% reduction in activities, a 14% reduction in facilities, a 10% reduction in DoD capacity, and a 20% reduction in DoD excess capacity. The resulting breakout by service is:

a. Air Force: 3 activities, 15 facilities
b. Navy: 4 activities, 44 facilities
c. Army: 2 activities, 9 facilities

Implementing the Core-1(A/W) open air range realignment option, in addition to the "non-core" T&E JCSG alternatives, will reduce the number of facilities by an additional six (6), will reduce the number of ranges to two (2), and will eliminate 37% of the DoD open air range capacity and 67% of the DoD open air range excess capacity. This option focuses on the MRTFB open air ranges which captures the highest Armament/Weapons T&E DoD costs. The resulting breakout by service is:

a. Air Force: 3 activities, 15 facilities
b. Navy: 4 activities, 41 facilities
c. Army: 2 activities, 6 facilities

Implementing the Core-2(A/W) ground test facility option, in addition to the Core-1(A/W) and "non-core" T&E JCSG alternatives, will maximize the DoD reductions achievable and reduce the DoD Armament/Weapons T&E infrastructure to the minimum level which meets DoD capability and capacity requirements. By moving (relocating) three (3) NAWC Pt Mugu measurement facilities to China Lake and management transferring the Strike Weapons Evaluation Facility to China Lake, the number of Armament/Weapons T&E activities could be reduced to six (6). The number of facilities are minimized at thirty-seven (37), and the DoD excess capacity is reduced by 70%. The resulting breakout by service is:

| | |
|---|---|
| a. Air Force: | 3 activities, 15 facilities |
| b. Navy: | 2 activities, 17 facilities |
| c. Army: | 1 activity, 5 facilities |

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## Summary Armament/Weapons T&E

- Optimization Model Realigned Core and Non-Core Activities
  - 6 Activities and 29 Facilities
- Facility Level Capability/Capacity Analysis Identified Additional Realignment Opportunities
  - Potential to Significantly Reduce DoD Armament/Weapons T&E (Reduce up to 7 Activities and 42 Facilities)
- JCSG Alternatives Affected Only Non-Core Activities
  - 4 Activities and 11 Facilities
  - Reductions in Capacity and Excess Capacity Limited Due to "Non-Core Activity" Approach

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Results of the optimization model pointed to both "core" and "non-core" realignment opportunities which affected six (6) activities and twenty-nine (29) test facilities. The T&E JCSG limited the analysis to "non-core" T&E activities and recommended four (4) "non-core" activity realignments: NSWC Crane, NSWC Dahlgren, NSWC Indian Head, and Redstone Technical Test Center. Because the T&E JCSG restricted realignments to "non-core" activities, a substantial amount of excess capacity was retained at "core" T&E activities in the Armament/Weapons T&E infrastructure. By conducting the capability/capacity analysis at the facility level, a significant number of "core" realignment opportunities were identified. Up to seven (7) activities and forty-two (42) test facilities could potentially be eliminated from the Armament/Weapons T&E infrastructure.

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## Summary (Cont'd) Armament/Weapons T&E

- OAR Realignments to AFDTC Eglin/WSMR Reduce Number of Ranges to 2
  - Focuses on MRTFB Assets Under OSD T&E Control
  - AFDTC Eglin and WSMR Are Only Combination of OARs Which Satisfies DoD Weapon System Requirements and Policy Imperatives
  - Reduces DoD OAR Excess Capacity by 67%
- Ground Facility Realignments, in Addition to JCSG and Core-1 (A/W) OAR Realignments, Represent Maximum Achievable Reductions
  - However, Substantial Impacts to Navy and Army R&D and Surface-to-Surface T&E

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The potential "core" realignment opportunities are separated into two options. First, the Core-1(A/W) alternative focuses on MRTFB assets under OSD T&E control, and would realign Armament/Weapons open air range workload to AFDTC Eglin and White Sands Missile Range. By reducing the highest cost test facility category to two (2) "core" ranges, DoD open air range excess capacity would be reduced by 67%. Second, the Core-2(A/W) alternative would realign Armament/Weapons ground test facilities to achieve the maximum reductions. Although the ground test facility workload realignments substantially reduce DoD excess capacity, there could be significant impacts to Navy and Army research and development (R&D) and surface-to-surface testing.

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Capability/Capacity Analysis for Armament/Weapons T&E

## Open Air Range

| Activity | Facility | Projected Workload | Capacity | Excess Capacity |
|---|---|---|---|---|
| AFDTC Eglin | ASTE/GTR/Hellfire | 7,598 | 16,036 | 8,438 |
| WSMR | Nat'l Range | 6,658 | 15,606 | 8,948 |
| NAWC China Lake | A/G & EC Ranges | 2,169 | 3,986 | 1,817 |
| NAWC Pt Mugu | Sea Test Range | 4,068 | 11,609 | 7,541 |
| YPG | AVGS/AMR/AWIR | 2,055 | 3,997 | 1,942 |
| RTTC | Small Msl Range | 786 | 1,188 | 402 |
| NAWC WSMR | Desert Ship | 1,791 | 3,925 | 2,134 |
| Total | | 25,125 | 56,347 | **31,222** |

Mismatched Data: WSMR Warhead Test Moved to MF-GO
WSMR Materiel Test Kept Separate (6246 Test Hours)

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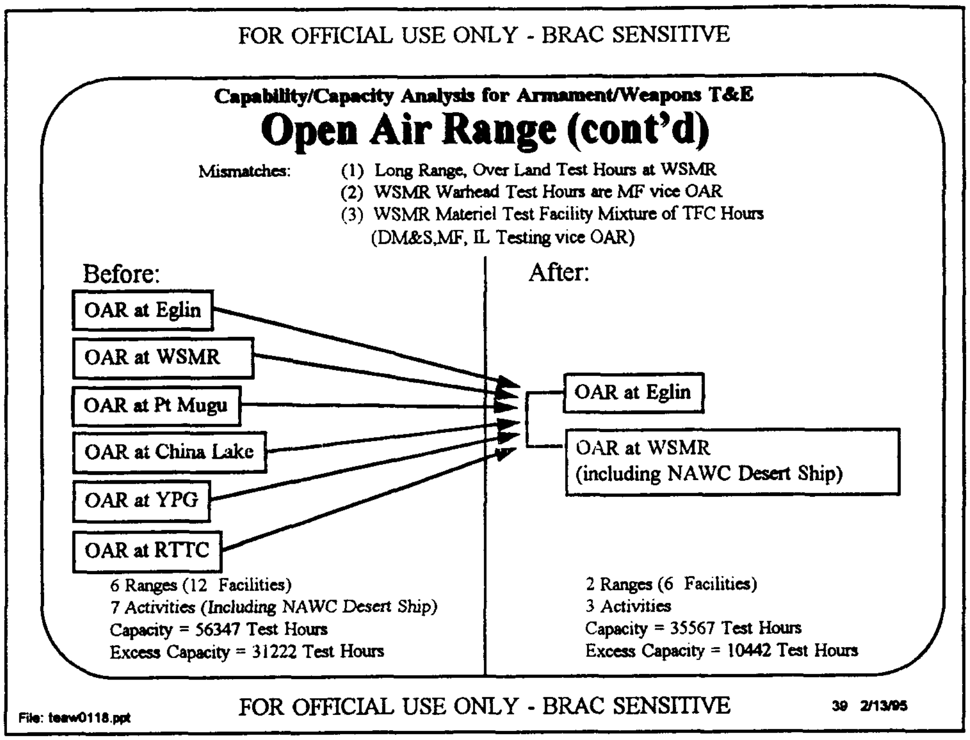
Fourteen (14) T&E facilities were categorized in the open air range test facility category. Facility evaluations identified two capability mismatches. First, WSMR's Warhead Test Branch is comparable to measurement facility guns/ordnance capabilities. The projected workload (371 test hours) and capacity (1110 test hours) are adjusted out of the open air range test facility category and moved to the measurement facility guns/ordnance test facility subcategory. Second, WSMR's Materiel Test Facility is a mixture of digital modeling and simulation, measurement, and integration testing versus open air range testing. Since WSMR did not provide data to facilitate separating the facility test hours into the digital modeling and simulation, measurement, and integration test facility categories, the test hours cannot be reasonably combined with other facilities in these test facility categories. Further, a portion of the Materiel Test Facility workload is support to the T&E open air range. These types of work at other activities are not included in the open air range workload and capacity. Therefore, the WSMR Materiel Test Facility projected workload (6246 test hours) and capacity (11,400 test hours) are kept separate for the remainder of the Armament/Weapons T&E analysis. The remaining twelve (12) facilities which represent six (6) ranges are listed in the following table with their activity, functional value (FV), projected workload, and capacity. Optimization model workload assigned to each activity (Opt Model Asgmt) and adjustments to the optimization model assignments (Adj Opt Asgmt) are also listed.

| Activity | FV | Name of Facility | Projected Workload | Capacity | Opt Model Asgmt | Adj Opt Asgmt |
|---|---|---|---|---|---|---|
| Eglin | 82 | *Armament Systems Test Environment / Gulf Test Facility / Hellfire | 7598 | 16036 | 16036 | 16036 |
| Pt Mugu | 77 | Sea Test Range | 4068 | 11609 | 11609 | 0 |
| China Lake | 57 | Air/Ground Range & EC Range | 2169 | 3986 | 3986 | 0 |
| WSMR | 50 | *National Range | 6658 | 15606 | 111 | 7298 |
| YPG | 29 | Air Vehicle-General Support / Aircraft Munitions Ranges / Aircraft Weapons Integration Range | 2055 | 3997 | 0 | 0 |
| NAWC WSMR | 25 | *Desert Ship, et al | 1791 | 3925 | 0 | 1791 |
| RTTC | 21 | Small Missile Range | 786 | 1188 | 0 | 0 |
| | | | | | | |
| Total | | | 25125 | 56347 | 31742 Note 1 | 25125 |

Note: * = Facility Retained

The optimization model workload assignments (see Note 1) include 371 test hours for WSMR's Warhead Test Branch and 6246 test hours for WSMR's Materiel Test Facility. When these hours are subtracted from 31,742 test hours the result (25,125 test hours) matches the total open air range projected workload and the total for the adjusted optimization model assignments. The adjusted optimization model workload assignments using 25,125 test hours vice 31,742 test hours are:

| Activity | FV | Adjusted Optimization Model Workload Assignment (Test Hours) |
|---|---|---|
| Eglin | 82 | 16036 |
| Pt Mugu | 77 | 9089 |
| China Lake | 57 | 0 |
| WSMR | 50 | 0 |
| YPG | 29 | 0 |
| NAWC WSMR | 25 | 0 |
| RTTC | 21 | 0 |




Additional facility evaluations indicate WSMR's National Range is the only facility which supports long-range, over-land missile testing. Therefore, the National Range test hours cannot be realigned into higher functional value activities. Similarly, the NAWC WSMR Desert Ship facility performs sea-based surface-to-air development testing which cannot be realigned into higher functional value activities. Adjustments to the optimization model output to realign WSMR and NAWC WSMR test hours, to delete WSMR Warhead Test Branch test hours, and to keep the WSMR Materiel Test Facility separate result in the following adjusted optimization model assignments:

| Activity | FV | Adjusted Optimization Model Workload Assignment (Test Hours) |
|---|---|---|
| Eglin | 82 | 16036 |
| Pt Mugu | 77 | 0 |
| China Lake | 57 | 0 |
| WSMR (including NAWC WSMR) | 50 | 9089 |
| YPG | 29 | 0 |
| RTTC | 21 | 0 |

The number of open air range activities are reduced from seven (7) to three (3) which are AFDTC Eglin, WSMR, and NAWC WSMR; the number of ranges are reduced from six (6) to two (2) which are AFDTC Eglin and WSMR; and the number of facilities are reduced from twelve (12) to six (6). These eliminations reduce DoD capacity by 20,780 test hours which is a 37% reduction in DoD open air range capacity and a 67% reduction in DoD open air range excess capacity.

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**Capability/Capacity Analysis for Armament/Weapons T&E**

## Potential Realignments

| Test Facility Category | Facilities |
|---|---|
| Digital Models and Simulations | 7 to 1 |
| MF - Environmental | 11 to 3 |
| MF - Electromagnetic | 3 to 2 |
| MF - Guidance | 11 to 5 (1) |
| MF - Guns/Ordnance | 10 to 4 |
| MF - Propulsion | 8 to 7 |
| MF - Sled Tracks | 3 to 2 |
| Integration Laboratory | 5 to 4 |
| Hardware-In-The-Loop | 6 to 2 (2) |
| Installed System Test Facility | 2 to 1 |
| Open-Air-Range | 13 to 6 (3) (6 to 2 Ranges) |

Note: (1) 2 EC Facilities at Pt Mugu Excluded
(2) Includes 1 Facility at Pt Mugu (DM&S, MF, IL Testing vice HITL)
(3) Includes 1 WSMR Facility (DM&S, MF, IL Testing vice OAR)

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The results of the facility level capability and capacity analysis are a significant number of potential realignment opportunities. By reducing the number of facilities performing Armament/Weapons T&E, the amount of DoD capacity and excess capacity can be substantially reduced. This chart identifies the current number of facilities (79) and the minimum number of facilities required (37) by test facility category and subcategory. In summary, forty-two (42) facilities can be realigned to reach the maximum achievable reduction in DoD capacity and excess capacity, and six (6) open air ranges can be reduced to two (2) ranges. This summary of potential realignments excludes the two (2) Electronic Combat measurement facilities at Pt Mugu and includes the Pt Mugu Strike Weapons Evaluation Facility and the WSMR Materiel Test Facility. Although the last two facilities were kept separate for realignment evaluation, they are added back to the hardware-in-the-loop and open air range test facility categories, respectively, for completeness.

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**Capability/Capacity Analysis for Armament/Weapons T&E**

## Adjusted Optimization Model Workload (Test Hours)

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| AFDTC Eglin | 82 | 55,305 | 28,736 | | 16,667 | 792 | 16,036 |
| NAWC Pt Mugu | 77 | 0 | 39,010 | 0 | (1) 0 | | 0 |
| NAWC China Lake | 57 | 0 | 13,609 | 13,368 | 0 | | 0 |
| NAWC Pax River | 57 | | | | | 0 | |
| WSMR | 50 | | 20,278 | | | | (2) 7,298 |
| AFDTC Holloman | 30 | | 21,812 | | | | |
| YPG | 29 | | 0 | | | | 0 |
| NAWC WSMR | 25 | | | | | | 1,791 |
| RTTC | 21 | | 0 | | | | 0 |
| NSWC Dahlgren | 17 | | 0 | | | | |
| AEDC Arnold | 16 | | 2,107 | | | | |
| NSWC Indian Head | 14 | | 0 | | | | |
| NSWC Crane | 13 | | 0 | | | | |

Note: (1) Plus 36,000 Test Hours (DM&S, MF, IL Testing)
(2) Plus 6,246 Test Hours (DM&S, MF, IL Testing)

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The optimization model outputs (workload assignments) discussed in the previous section were adjusted to eliminate capability and capacity mismatches and to reduce the number of facilities and activities. The results of these adjustments to the optimization model are shown by activity with workload separated into the six (6) test facility categories. Boxes around test hours indicate a change in workload assignment from the optimization model run. Zeros indicate an activity currently performs work in this test facility category, and its workload was realigned by the optimization model or by adjustments. Blanks indicate an activity did not submit workload against the test facility category.

Six (6) activities can be totally realigned (eliminated from Armament/Weapons T&E) -- NSWC Crane, NSWC Dahlgren, NSWC Indian Head, RTTC, YPG, and NAWC Pax River. NAWC Pt Mugu can be substantially realigned to provide predominately measurement facility testing, and NAWC China Lake can be realigned to provide measure and integration testing. By performing the analyses at the facility level forty-two (42) facilities, versus the optimization model's twenty-nine (29) facilities, can be realigned. The adjusted optimization model outputs indicate one (1) activity, AFDTC Eglin, is required to conduct testing across the test facility categories, two (2) ranges (AFDTC Eglin and WSMR) are required to provide open air range capability and capacity, and four (4) additional activities are needed to support specialized measurement and integration testing (NAWC China Lake, NAWC Pt Mugu, AFDTC Holloman, and AEDC Arnold). These workload assignments provide the maximum achievable reduction in Armament/Weapons T&E facilities. Further reductions in the number of activities supporting Armament/Weapons T&E can be accomplished by relocating facilities.

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Capability/Capacity Analysis for Armament/Weapons T&E

## Adjusted Optimization Model Outputs

- Adjustments to the Optimization Model Output to Eliminate Mismatches and to Consolidate Facilities Increased the Number of Realignment Opportunities
  - Realignment of 42 out of 79 Facilities
  - 35% Reduction in DoD Capacity
  - 70% Reduction in DoD Excess Capacity
- Baseline Workload and Capacity Data Adjusted to Eliminate Test Facility Category and Functional Area Mismatches

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In summary, the facility level capability and capacity analysis increases the number of facility realignment opportunities. Forty-two (42) out of seventy-nine (79) facilities could be realigned which reduces the total number of DoD Armament/Weapons T&E facilities to thirty-seven (37). Eliminating 189,697 test hours of DoD capacity results in a 35% reduction in DoD capacity and a 70% reduction in DoD excess capacity. Adjustments to the optimization model output to eliminate test facility category and functional area mismatches must be made to the Armament/Weapons T&E baseline data to ensure comparable data are presented and used in comparison of alternatives.


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Capability/Capacity Analysis for Armament/Weapons T&E

## Adjusted DoD Workload Baseline (Test Hours)

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| AFDTC Eglin | 82 | 39,324 | 13,144 | | 12,085 | 168 | 7,598 |
| NAWC Pt Mugu | 77 | 3,916 | $\boxed{17,298}$ | 5,774 | $\boxed{^{(1)}3,225}$ | | 4,068 |
| NAWC China Lake | 57 | 12,065 | 45,387 | 7,594 | 1,357 | | 2,169 |
| NAWC Pax River | 57 | | | | | 624 | |
| WSMR | 50 | | $\boxed{7,979}$ | | | | $\boxed{^{(2)}6,658}$ |
| AFDTC Holloman | 30 | | 5,129 | | | | |
| YPG | 29 | | 127 | | | | 2,055 |
| NAWC WSMR | 25 | | | | | | 1,791 |
| RTTC | 21 | | 30,089 | | | | 786 |
| NSWC Dahlgren | 17 | | 954 | | | | |
| AEDC Arnold | 16 | | 2,107 | | | | |
| NSWC Indian Head | 14 | | 2,196 | | | | |
| NSWC Crane | 13 | | 1,142 | | | | |

Note: (1) Plus 36,000 Test Hours (DM&S, MF, IL Testing)
(2) Plus 6,246 Test Hours (DM&S, MF, IL Testing)

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The baseline Armament/Weapons T&E workload data are adjusted as indicated by boxes around the workload numbers to reflect the following realignments:

a. The Pt Mugu Monostatic and Bistatic Radar Reflectivity Lab workloads are eliminated from the measurement facility guidance subcategory, since the workload should be aligned with the Electronic Combat functional area. These adjustments are 464 test hours for the Monostatic Radar Reflectivity Lab and 513 test hours for the Bistatic Radar Reflectivity Lab. Together, they reduce Pt Mugu's measurement facility workload from 18,275 test hours to 17,298 test hours.
b. Pt Mugu's Strike Weapons Evaluation Facility workload (36,000 test hours) is separated from hardware-in-the-loop test hours. Pt Mugu's hardware-in-the-loop workload is reduced from 39,225 test hours to 3225 test hours, and the 36,000 test hours are retained separately at the bottom of the chart in Note (1).
c. The WSMR Warhead Test Branch workload (371 test hours) is moved from the open air range test facility category to the measurement facility guns/ordnance subcategory. These adjustments increase WSMR's measurement facility workload from 7608 test hours to 7979 test hours and decrease WSMR's open air range workload from 13,275 test hours to 12,904 test hours.
d. The WSMR Materiel Test Facility workload (6246 test hours) is separated from open air range test hours which reduces WSMR's open air range workload from 12,904 test hours to 6658 test hours. The 6246 test hours are retained separately at the bottom of the chart in Note (2).

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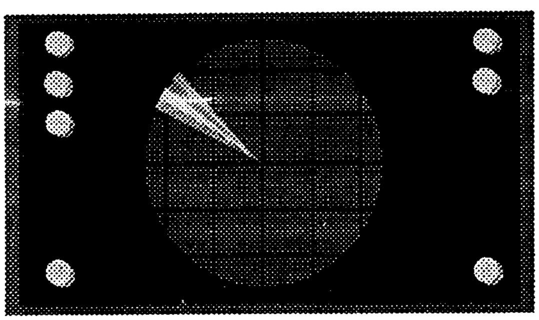
# Annex 1

# Air Force BRAC '95 Analysis of T&E Infrastructure

## Completion of T&E JCSG Analysis Plan

## Electronic Combat T&E Analysis



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# Annex 1
# of the
# Air Force BRAC '95 Analysis
# of
# T&E Infrastructure

**Completion of T&E JCSG Analysis Plan**

**Electronic Combat T&E Analysis**

**February 1995**

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This annex, in scripted briefing format, discusses completion of the Test and Evaluation (T&E) Joint Cross Service Group Analysis Plan for "core" T&E activities for the electronic combat (EC) functional area.

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## Purpose

- Complete T&E JCSG Analysis Plan for EC Functional Area

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The purpose of this briefing is to complete the T&E JCSG analysis plan for the EC functional area. The T&E JCSG analysis plan was jointly developed and approved by the T&E JCSG over the period of April-September 1994. The T&E JCSG carried out the plan, which consisted of analyzing capabilities and capacities, determining the functional value of each T&E activity, conducting several runs (according to different objective functions) of an optimization model, and finally developing realignment alternatives for consideration by the military departments. Unfortunately, the T&E JCSG only developed alternatives for "non-core" T&E activities, and restricted the T&E JCSG working group from jointly developing alternatives for realignments among "core" T&E activities. If only the T&E JCSG alternatives for "non-core" activities are implemented, significant excess capacity will remain among "core" T&E activities (70 percent of the EC activities are classified as such). Since it was left to the individual Services to address this excess capacity, the Air Force completed the T&E JCSG analysis plan for "core" activities by analyzing realignments to the test facility level.

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# Outline

- EC T&E Baseline
- Optimization Model Outputs
- Capability/Capacity Analysis
- DoD Requirements Analysis
- Alternatives
- Summary

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This briefing will first present the EC T&E baseline of activities/facilities, with corresponding capabilities and capacities, that exists today. Results of optimization model runs are discussed next, followed by a capability and capacity analysis. This analysis, combined with information from the DoD requirements analysis in the next section, forms the basis for the alternatives which follow. Finally, a summary of the EC T&E functional area analysis concludes the briefing.

All of the data pertinent to the next section (electronic combat T&E baseline) was taken directly from the T&E JCSG certified data and jointly developed results.

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## EC T&E Baseline
## Activities and Functional Value

| Department | Activity | Functional Value | Facilities | MRTFB |
|---|---|---|---|---|
| AF | AFDTC, Eglin AFB | 65 | 4 | Yes |
| | AFFTC, Edwards AFB | 52 | 2 | Yes |
| | AFDTC, Holloman | 29 | 2 | Yes |
| | AFDTC, AFEWES | 17 | 1 | No |
| | AFDTC, REDCAP | 15 | 1 | No |
| | **Total Air Force** | | **10** | |
| Navy | NAWC, Pt Mugu | 58 | 3 | Yes |
| | NAWC, Pax River | 53 | 2 | Yes |
| | NAWC, China Lake | 47 | 3 | Yes |
| | NSWC, Crane | 17 | 1 | No |
| | **Total Navy** | | **9** | |
| Army | EPG | 47 | 5 | Yes |
| **DoD Total** | | | **24** | |

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There are currently ten DoD activities involved in electronic combat (EC) test and evaluation (T&E). Located at these ten activities are 24 individual facilities with EC T&E capability and workload. This chart lists the Air Force, Navy and Army EC T&E activities and the number of facilities at each. The T&E functional value for each activity (as determined by the Joint Cross Service Group) is also shown, as is whether or not each activity is included in the DoD Major Range and Test Facility Base (MRTFB).

The Nellis Range Complex was excluded from the JCSG working group analysis per direction from the JCSG. Although there was no functional value calculated for this facility, it was designated by the JCSG as the primary DoD receiver site for EC OAR workload. The Nellis range is also an MRTFB activity.

The MRTFB designation is important because all MRTFB activities were deemed to be "core" for T&E purposes. Thus, only three of the ten DoD activities involved in EC testing were subject to potential realignment recommendations by the JCSG working group.

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# EC T&E Baseline
## DoD Facilities

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| AFDTC Eglin | 65 | | 2 | | | 1 | 1 |
| NAWC Pt Mugu | 58 | | 1 | 1 | 1 | | |
| NAWC Pax River | 53 | | 1 | | | 1 | |
| AFFTC Edwards | 52 | | | 1 | | | 1 |
| NAWC China Lake | 47 | | 1 | 1 | | | 1 |
| EPG | 47 | 1 | 3 | | | | 1 |
| AFDTC Holloman | 29 | | 2 | | | | |
| AFDTC AFEWES | 17 | | | | 1 | | |
| NSWC Crane | 17 | | 1 | | | | |
| AFDTC REDCAP | 15 | | | | 1 | | |
| **Total** | | 1 | 11 | 3 | 3 | 2 | 4 |

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The 24 DoD facilities involved in supporting EC T&E are distributed across the ten activities and six test facility categories (TFCs) as shown on this chart. It is notable that no more than one facility within a test facility category exists at any activity, with the exception of measurement facilities (which, in all cases, are of different TFC subcategories when more than one is located at a particular activity). The eleven measurement facilities doing EC T&E work fall into six different TFC subcategories, as will be described on subsequent charts.

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# EC T&E Baseline
## DoD Capacity (Test Hours)

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| AFDTC Eglin | 65 | | 5384 | | | 2202 | 1978 |
| NAWC Pt Mugu | 58 | | 788 | 850 | 420 | | |
| NAWC Pax River | 53 | | 218 | | | 4550 | |
| AFFTC Edwards | 52 | | | 5126 | | | 1200 |
| NAWC China Lake | 47 | | 3483 | 2458 | | | 1821 |
| EPG | 47 | 1010 | 3409 | | | | 861 |
| AFDTC Holloman | 29 | | 12320 | | | | |
| AFDTC AFEWES | 17 | | | | 9130 | | |
| NSWC Crane | 17 | | 6301 | | | | |
| AFDTC REDCAP | 15 | | | | 1040 | | |

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This chart lists the ten DoD activities involved in electronic combat test and evaluation according to their JCSG-derived functional value. Also shown are the six test facility categories (TFCs) and the capacity (in test hours/year) of each activity to accomplish workload in every TFC for which it has an applicable facility. It is apparent that the activities having the highest EC T&E functional values are also those having facilities in several TFCs.

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# EC T&E Baseline

## DoD Workload (Test Hours)

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| AFDTC Eglin | 65 | | 2390 | | | 761 | 899 |
| NAWC Pt Mugu | 58 | | 487 | 459 | 223 | | |
| NAWC Pax River | 53 | | 148 | | | 2843 | |
| AFFTC Edwards | 52 | | | 3088 | | | 758 |
| NAWC China Lake | 47 | | 2311 | 1770 | | | 745 |
| EPG | 47 | 246 | 858 | | | | 369 |
| AFDTC Holloman | 29 | | 6091 | | | | |
| AFDTC AFEWES | 17 | | | | 2524 | | |
| NSWC Crane | 17 | | 4344 | | | | |
| AFDTC REDCAP | 15 | | | | 86 | | |

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This chart is similar to the previous one except that, here, workload (in terms of test hours/year projected for the year 2001) is shown in place of capacity. Figures on this chart are directly related to the quantity of electronic combat T&E work being accomplished at each facility today. Comparing this chart to the previous one allows determination of where and how much excess capacity exists, and in which test facility categories.



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# EC T&E Baseline

## DoD Workload and Capacity Summary

| Test Facility Category | Facilities | Capacity (Test Hours) | Projected Workload (Test Hours) | Excess Capacity (Test Hours) |
|---|---|---|---|---|
| Digital Models and Simulations | 1 | 1010 | 246 | 764 |
| MF - Communications | 2 | 1226 | 298 | 928 |
| MF - Environmental | 2 | 5431 | 2174 | 3257 |
| MF - Electromagnetic | 2 | 7927 | 4929 | 2998 |
| MF - Guidance | 1 | 2400 | 1728 | 672 |
| MF - RCS | 2 | 13763 | 6674 | 7089 |
| MF - Signature Measurement | 2 | 1516 | 826 | 690 |
| Integration Laboratory | 3 | 8434 | 5317 | 3117 |
| Hardware-In-The-Loop | 3 | 10590 | 2833 | 7757 |
| Installed System Test | 2 | 6752 | 3604 | 3148 |
| Open-Air-Range | 4 | 5860 | 2771 | 3089 |
| **Total** | **24** | 64909 | 31400 | **33509** |

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Workload and capacity within each of the six test facility categories (and six subcategories of measurement facilities) are generally unique. That is, a facility capable of performing work in one test facility category (with few exceptions) is normally unable to accomplish work in other TFCs. This chart shows each test facility category and subcategory and the number of DoD facilities having capacity and doing work in each. Subtracting projected workload from capacity yields the excess capacity within each test facility category and subcategory. By reviewing each test facility category and subcategory for the amount of excess capacity and the number of facilities accomplishing the workload, potential opportunities for realignment become apparent.

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# EC T&E Baseline
## Air Force Workload and Capacity

| Test Facility Category | Facilities | Capacity (Test Hours) | Projected Workload (Test Hours) | Excess Capacity (Test Hours) | % of DoD Execss Cap |
|---|---|---|---|---|---|
| MF - Environmental | 1 | 4656 | 2051 | 2605 | 80 |
| MF - Guidance | 1 | 2400 | 1728 | 672 | 100 |
| MF - RCS | 1 | 9920 | 4363 | 5557 | 78 |
| MF - Signature Measurement | 1 | 728 | 339 | 389 | 56 |
| Integration Laboratory | 1 | 5126 | 3088 | 2038 | 65 |
| Hardware-In-The-Loop | 2 | 10170 | 2610 | 7560 | 97 |
| Installed System Test | 1 | 2202 | 761 | 1441 | 48 |
| Open-Air-Range | 2 | 3178 | 1657 | 1521 | 49 |
| Total | **10** | 38380 | 16597 | **21783** | **65** |

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There are ten Air Force facilities accomplishing electronic combat testing in eight of the eleven test facility categories/subcategories. Total Air Force capacity, projected workload, and excess capacity for each category/subcategory is shown. Across all Services, the Air Force produces the most EC test capacity, accomplishes the most workload, and has the most excess capacity. However, with the exception of two test facility categories (HITLs and OARs), the Air Force has only one facility involved in each TFC. Internal Air Force realignments propose to realign workload from both HITLs and one OAR, leaving only one facility remaining within each test facility category. Beyond this, excess capacity cannot be reduced further without realigning the remaining single facility (and thus eliminating all Air Force capability) within a TFC

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# EC T&E Baseline

## Navy Workload and Capacity

| Test Facility Category | Facilities | Capacity (Test Hours) | Projected Workload (Test Hours) | Excess Capacity (Test Hours) | % of DoD Execss Cap |
|---|---|---|---|---|---|
| MF - Communications | 1 | 218 | 148 | 70 | 8 |
| MF - Electromagnetic | 1 | 6301 | 4344 | 1957 | 65 |
| MF - RCS | 1 | 3843 | 2311 | 1532 | 22 |
| MF - Signature Measurement | 1 | 788 | 487 | 301 | 44 |
| Integration Laboratory | 2 | 3308 | 2229 | 1079 | 35 |
| Hardware-In-The-Loop | 1 | 420 | 223 | 197 | 3 |
| Installed System Test | 1 | 4550 | 2843 | 1707 | 54 |
| Open-Air-Range | 1 | 1821 | 745 | 1076 | 35 |
| Total | 9 | 21249 | 13330 | 7919 | 24 |

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This chart depicts the Navy's EC test capacity, workload, and excess capacity. The Navy has nine facilities which, together, produce a capacity slightly larger than half of the Air Force's. Navy facilities contribute 24% of DoD's excess EC T&E capacity, much of which is in the measurement facility and ISTF TFCs.

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# EC T&E Baseline
## Army Workload and Capacity

| Test Facility Category | Facilities | Capacity (Test Hours) | Projected Workload (Test Hours) | Excess Capacity (Test Hours) | % of DoD Execss Cap |
|---|---|---|---|---|---|
| Digital Models and Sims | 1 | 1010 | 246 | 764 | 100 |
| MF - Communications | 1 | 1008 | 150 | 858 | 92 |
| MF - Environmental | 1 | 775 | 123 | 652 | 20 |
| MF - Electromagnetic | 1 | 1626 | 585 | 1041 | 35 |
| Open-Air-Range | 1 | 861 | 369 | 492 | 16 |
| Total | 5 | 5280 | 1473 | **3807** | **11** |

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Although the Army has five facilities involved in EC T&E, three are measurement facilities and all are located at one activity (EPG). Army facilities generate a total EC T&E capacity equal to 14% of the Air Force's, and contribute 11% of DoD's excess capacity. Coincidentally, both the Navy and Army have significant excess capacity in electromagnetic measurement facilities, which will be addressed in the following JCSG recommendations.

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# EC T&E Workload and Capacity (Hours/Year)

| Service | Activities | Facilities | Capacity (Test Hours) | Projected Workload (Test Hours) | Excess Capacity (Test Hours) | % of Excess Capacity |
|---|---|---|---|---|---|---|
| AF | 5 | 10 | 38380 | 16597 | 21783 | 65 |
| Navy | 4 | 9 | 21249 | 13330 | 7919 | 24 |
| Army | 1 | 5 | 5280 | 1473 | 3807 | 11 |
| Total | **10** | **24** | 64909 | 31400 | **33509** | |

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Army, Navy, and Air Force EC T&E activities, facilities, capacities and workload are summed on this chart. It is notable that the Air Force has half the activities, over 40% of the facilities, and over half of the entire DoD EC T&E projected workload. The Air Force also generates the majority of DoD excess capacity, much of which will be addressed via intra-AF realignment proposals.

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# Outline

- EC T&E Baseline
- Optimization Model Outputs
- Capability/Capacity Analysis
- DoD Requirements Analysis
- Alternatives
- Summary

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The T&E JCSG data from the last section (pertaining to existing electronic combat T&E workload and capacities) was fed into the tri-department, BRAC approved optimization model. The output, approved by the T&E JCSG, was used as a tool to identify potential areas for realignment. This next section of the briefing discusses the model's results.

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# Optimization Model Outputs
## EC T&E

| Activity | MAXSFV (W=0) | MINSITES (W=95) | MAXSFV (MINSITES) | MINXCAP (W=100) | MAXSFV (nsite) | MIN NMV (W=95) | Summary |
|---|---|---|---|---|---|---|---|
| | Objective Functions | | | | | | |
| AFDTC, Eglin AFB | 1 | 1 | 1 | 1 | 1 | 1 | Retain |
| NAWC, Pt Mugu | 1 | 1 | 1 | 1 | 1 | 1 | Retain |
| NAWC, Pax River | 1 | 1 | 1 | 1 | 1 | 1 | Retain |
| AFFTC, Edwards AFB | 1 | 1 | 1 | 1 | 1 | 1 | Retain |
| NAWC, China Lake | i | 0 | 0 | 0 | 0 | 0 | Realign |
| EPG | 1 | 1 | 1 | 1 | 1 | 1 | Retain |
| AFDTC, Holloman | 1 | 1 | 1 | 1 | 1 | 1 | Retain |
| AFDTC, AFEWES | 1 | 1 | 1 | 1 | 1 | 1 | Retain |
| NSWC, Crane | 1 | 1 | 1 | 1 | 1 | 1 | Retain |
| AFDTC, REDCAP | 0 | 0 | 0 | 0 | 0 | 0 | Realign |

1 = Retain    0 = Realign

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The optimization model was run six times, each for a different objective function. Objective functions are described in detail in the JCSG analysis plan, and are discussed in the main body of this report

In terms of activities, the model output was basically identical under five of the six objective functions. The "summary" column summarizes the model's output, which basically indicates that (considering EC T&E functional value, capacities and workload) DoD can best be served by realigning all Electronic Combat test workload from NAWC China Lake and AFDTC REDCAP. Unfortunately, NAWC China Lake was designated a core T&E activity by the JCSG, eliminating all facilities located thereon from realignment consideration by the JCSG working group. Realignment of AFDTC REDCAP (along with two other EC test activities) was considered by the JCSG working group, and will be described in greater detail in following charts.

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## Optimization Model Output (Test Hours)

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| AFDTC, Eglin AFB | 65 | | 2902 | | | 2202 | 1978 |
| NAWC, Pt Mugu | 58 | | 98 | 850 | 420 | | |
| NAWC, Pax River | 53 | | 0 | | | 1402 | |
| AFFTC, Edwards AFB | 52 | | | 4467 | | | 112 |
| NAWC, China Lake | 47 | | 0 | 0 | | | 0 |
| EPG | 47 | 246 | 1924 | | | | 0 |
| AFDTC, Holloman | 29 | | 8402 | | | | |
| AFDTC, AFEWES | 17 | | | | 2413 | | |
| NSWC, Crane | 17 | | 3303 | | | | |
| AFDTC, REDCAP | 15 | | | | 0 | | |

2 Activities and 6 Facilities Realigned

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Optimization model inputs included total projected workload for each test facility category and the capacity of each activity to accommodate same. The model then attempted to reallocate workload to those activities having capacity in the respective TFC, starting with the activity having the highest functional value and continuing until all projected workload was assigned. Thus, the model basically shifted workload from activities with the lowest functional values to those with the highest within individual test facility categories. Although some capability mismatches occurred, especially in measurement facilities and integration laboratories, optimization model outputs thus identified two activities (NAWC China Lake and AFDTC REDCAP) and six facilities from which all workload could be realigned. These are identified as having no workload on this chart, and include the open air range at EPG and the communications measurement facility at NAWC Patuxent River (in addition to all three EC T&E facilities at NAWC China Lake and the one at AFDTC REDCAP).

Within measurement facilities, all workload was not shifted to those activities having the highest functional values because capability and workload across test facility subcategories (MF-communications, MF-electromagnetic environmental effects, MF-radar cross section, and MF-signature measurement) are generally incompatible.

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# Optimization Model Outputs Electronic Combat T&E

- Optimization Model Workload Assignments Point To:
  - Realignment of 2 of 10 Activities (Core and Non-Core)
  - Realignment of 6 of 24 Facilities
  - 16% Reduction in DoD Capacity
  - 31% Reduction in DoD Excess Capacity
- Additional Workload Realignments Needed to Eliminate Capability and Capacity Mismatches

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The results of optimization model runs for the EC T&E functional area can be summarized as shown on this chart. The specific activities and facilities recommended for realignment are as previously shown. Since approximately half of DoD's EC test capacity is excess to projected requirements and all reductions in capacity are subtracted from the quantity identified as excess, the percentage decrease in excess capacity is roughly twice the percentage reduction in overall EC capacity. Because some realignments recommended by the model are infeasible due to capability and capacity mismatches, model outputs must be adjusted for these factors.

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# Adjusted Optimization Model Outputs Electronic Combat T&E

- Adjusted Optimization Model Workload Assignments Point To:
  - Realignment of 1 of 10 Activities (Non-Core)
  - Realignment of 4 of 24 Facilities
  - 11% Reduction in DoD Capacity
  - 21% Reduction in DoD Excess Capacity

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Adjusting optimization model outputs to eliminate capability and capacity mismatches produces the top level results shown on this chart. Basically, two of the facilities recommended for realignment by the optimization model (the integration laboratory at NAWC China Lake and the open air range at EPG) are technically infeasible, limiting the suggested reductions in test facilities/activities and capacity/excess capacity to the figures shown on this chart.



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## Outline

- EC T&E Baseline
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- Summary

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Once outputs of the optimization model were available, a capability and capacity analysis could be done to investigate realignment opportunities highlighted by the model.

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## Capability/Capacity Analysis for EC T&E Approach

- Use Optimization Model Output As Basis for Further Analysis at the Facility Level
  - JCSG Alternatives Included
- Identify Capability/Capacity Mismatches and Opportunities to Realign at the Facility Level
  - Based on Model Outputs and Certified Data
- Identify Additional Opportunities to Realign Across Test Facility Categories and Functional Areas
  - Realign to Minimize Number of Activities and Facilities
- Adjust Model Output and Configuration Baseline
  - Move Workload to Activity with Highest Functional Value and Required Capability (Unless Compelling Reason to do Otherwise)
  - Preserve Test Process and Unique Capabilities

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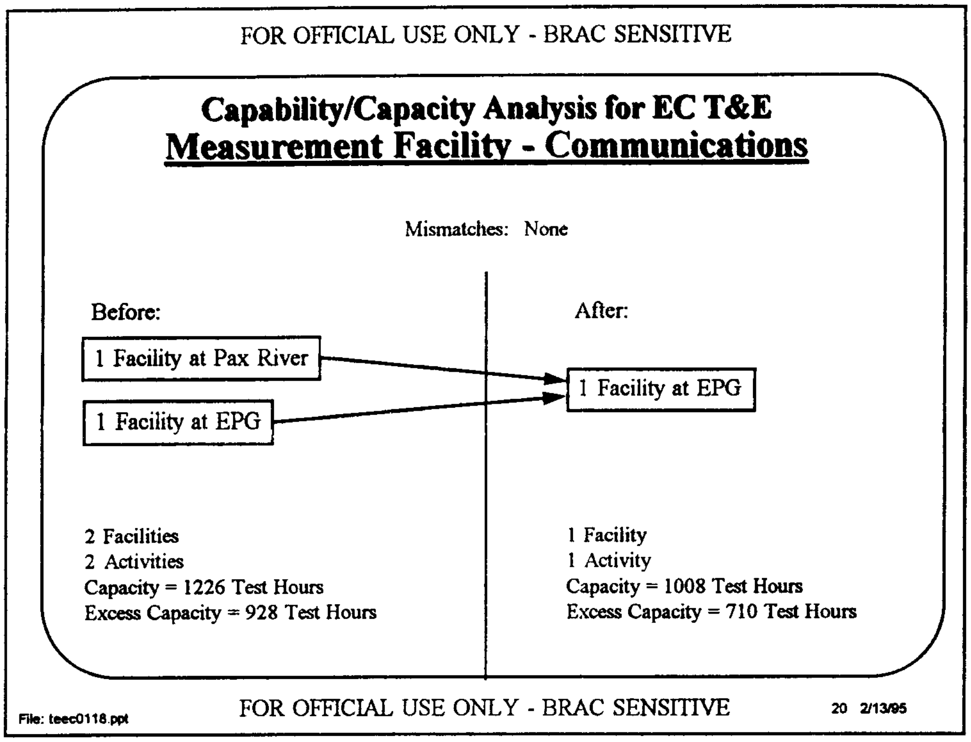
Optimization model outputs were used as tools for identifying test facility categories with potential realignment opportunities. Alternatives developed by the Joint Cross Service Group (JCSG) were included opportunities but, because JCSG policy prohibited realigning work from core T&E activities, these alternatives did not do enough to reduce excess capacity. Completion of the JCSG-developed analysis plan required reviewing capabilities, capacities and workload on a facility by the facility basis. Some potential realignment opportunities identified by the optimization model were infeasible due to capability or capacity mismatches.

Additionally, further potential realignment opportunities were identifiable if compatible capabilities were allowed to accept workload across functional and mission area lines. Although the optimization model could not make such trade-offs, human judgment allows them and they (in turn) enable reductions in unnecessary excess capacity which will otherwise be retained.

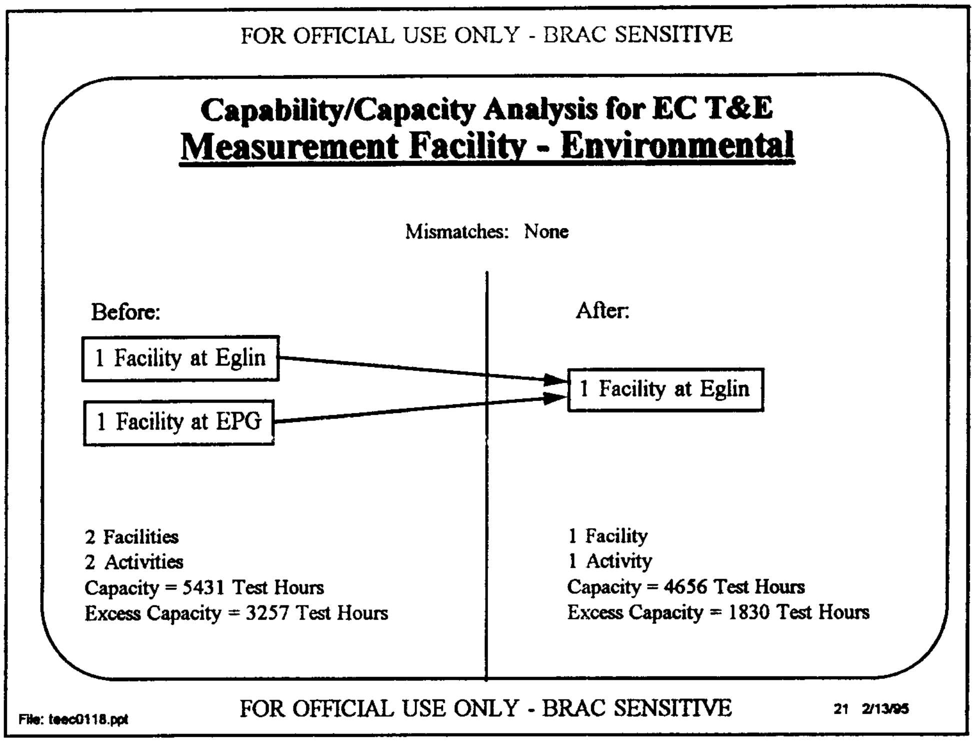
General guidelines under which the analysis was conducted included the necessity to reduce numbers of activities and facilities to the minimum possible, to collocate ground and open air range facilities at an MRTFB activity when able, to maintain unique test capabilities and the ability to implement all phases of the Electronic Warfare Test Process, and to locate workload at those activities having the highest functional values (unless there is a compelling reason to do otherwise).




There are currently two facilities conducting communications measurement facility work, both of which are located at a core T&E activities. Over 75% of the EC T&E capacity generated at these two facilities is excess to projected workload requirements.

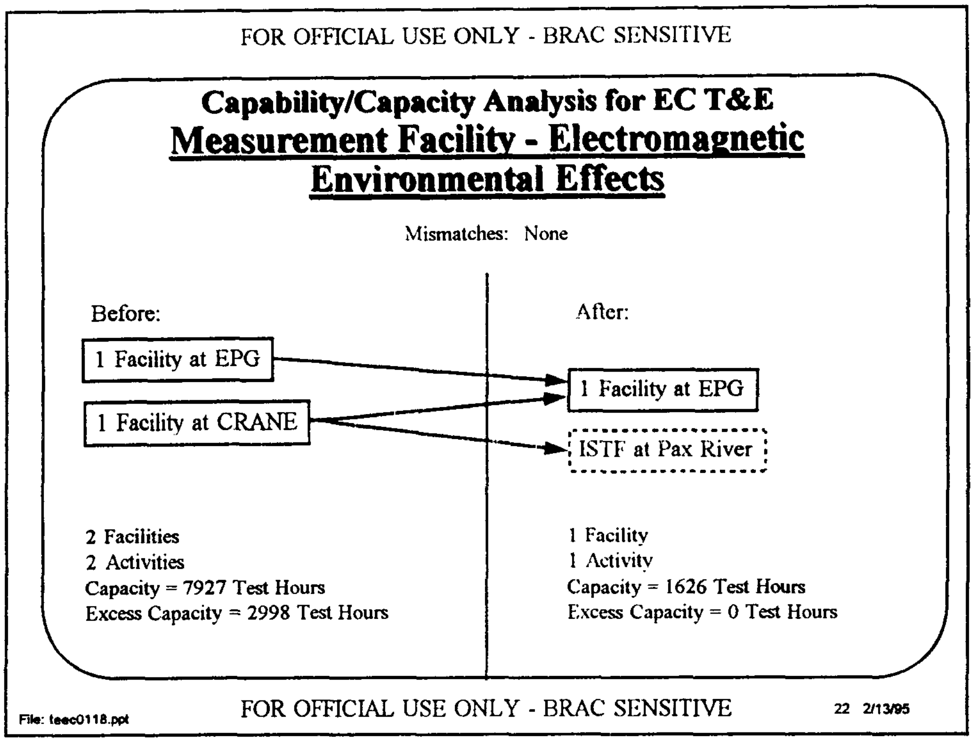
Although NAWC Patuxent River has a higher EC T&E functional value than EPG (53 vs 47), EPG has the capacity to accommodate all communications measurement workload while Patuxent River does not. Concentrating all communications measurement facility work at EPG will reduce the number of EC T&E facilities by one and decrease excess capacity by 218 hours.

This proposed realignment is included in the "other core realignments" category as the communications measurement facility at NAWC Patuxent River does work in other functional areas and impacts thereto may yet be unknown.




There are currently two facilities doing environmental effects measurement work in support of EC, both of which are located at core T&E activities. Together, these facilities generate a large capacity, approximately 60% of which is excess to projected workload requirements. AFDTC Eglin has the highest functional value of the two activities involved and its McKinley Climatic Laboratory has the capability and sufficient capacity to accommodate all environmental effects workload from EPG (FVs are 65 and 47 respectively). Combining all environmental effects measurement workload at AFDTC Eglin would reduce the number of facilities involved in EC T&E by one and decrease excess capacity by 1427 hours.

This proposed realignment is included in the "other core realignments" category as the environmental effects measurement facility at EPG does work in other functional areas and impacts thereto may not yet be known.




There are currently two facilities doing electromagnetic environmental effects measurement work in support of EC. One of these facilities (EPG) is located at a core T&E activity; the other (NSWC Crane) is not. Together, these two facilities generate a large capacity, approximately 38% of which is excess to projected requirements.

In addition to being located at a core T&E activity, EPG also has a higher EC T&E functional value than NSWC Crane (47 vs 17 respectively). Although EPG cannot absorb all electromagnetic environmental effects workload from NSWC Crane, the Navy's installed systems test facility at NAWC Patuxent River can easily accommodate the rest. Combining all electromagnetic environmental effects measurement workload at EPG and NAWC Patuxent River would reduce the number of facilities and activities involved in EC T&E each by one, decrease excess capacity by 1372 hours, and focus such testing at MRTFB activities possessing EC OARs.

This proposed realignment was recommended by the JCSG as TE-3 (EC).

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**Capability/Capacity Analysis for EC T&E**

**Measurement Facility - Radar Cross Section**

Mismatches: China Lake Does Not Have Capability Comparable to RATSCAT Advanced Measurement System at Holloman

| Before: | After: |
|---|---|
| 1 Facility at China Lake → 1 Facility at Holloman<br>1 Facility at Holloman → 1 Facility at Holloman | 1 Facility at Holloman |
| 2 Facilities<br>2 Activities<br>Capacity = 13763 Test Hours<br>Excess Capacity = 7089 Test Hours | 1 Facility<br>1 Activity<br>Capacity = 9920 Test Hours<br>Excess Capacity = 3246 Test Hours |

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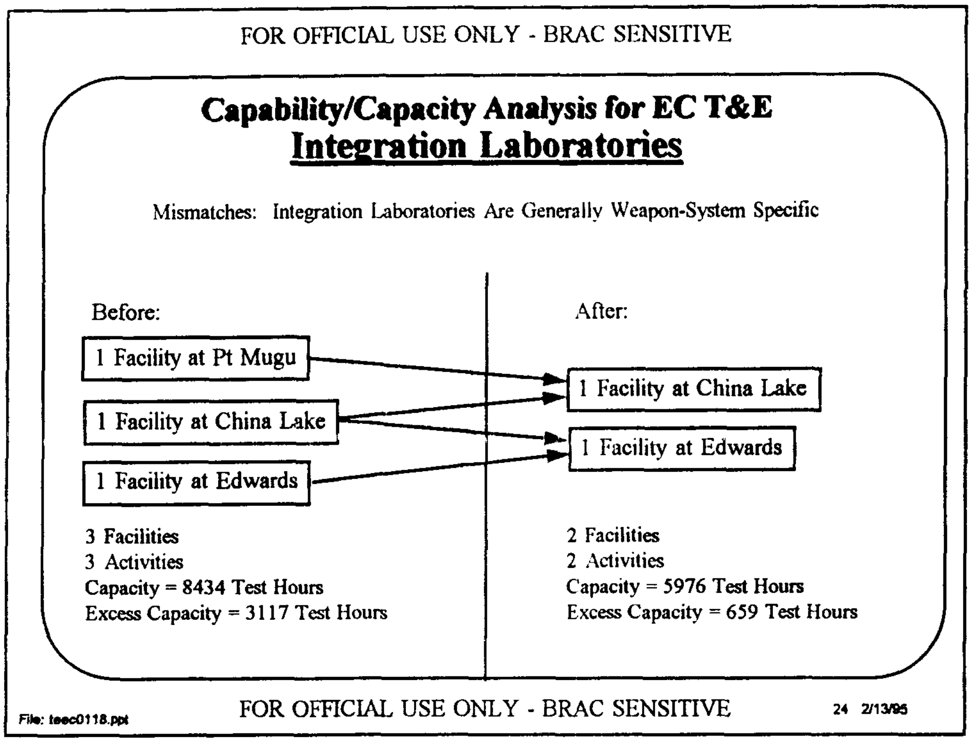
There are currently two facilities doing static radar cross section (RCS) measurement work in support of EC, both of which are located at core T&E activities. Together, these two facilities generate a large capacity, approximately 52% of which is excess to projected workload requirements.

Although NAWC China Lake has a higher EC T&E functional value than AFDTC Holloman, both the Radar Target Scatter (RATSCAT) Facility and the RATSCAT Advanced Measurement System (RAMS) are located at Holloman AFB. These facilities have both the capability and capacity to absorb workload now being performed at the Junction Ranch RCS measurement facility at China Lake NAS. The converse is not true: China Lake has neither the capability (it has only a RATSCAT - equivalent system) nor the capacity (2831 hour/year shortfall) to accommodate the RCS measurement workload now being done at AFDTC Holloman. Combining all static RCS measurement workload at AFDTC Holloman would reduce the number of facilities involved in EC T&E by one and decrease excess capacity by 3843 hours.

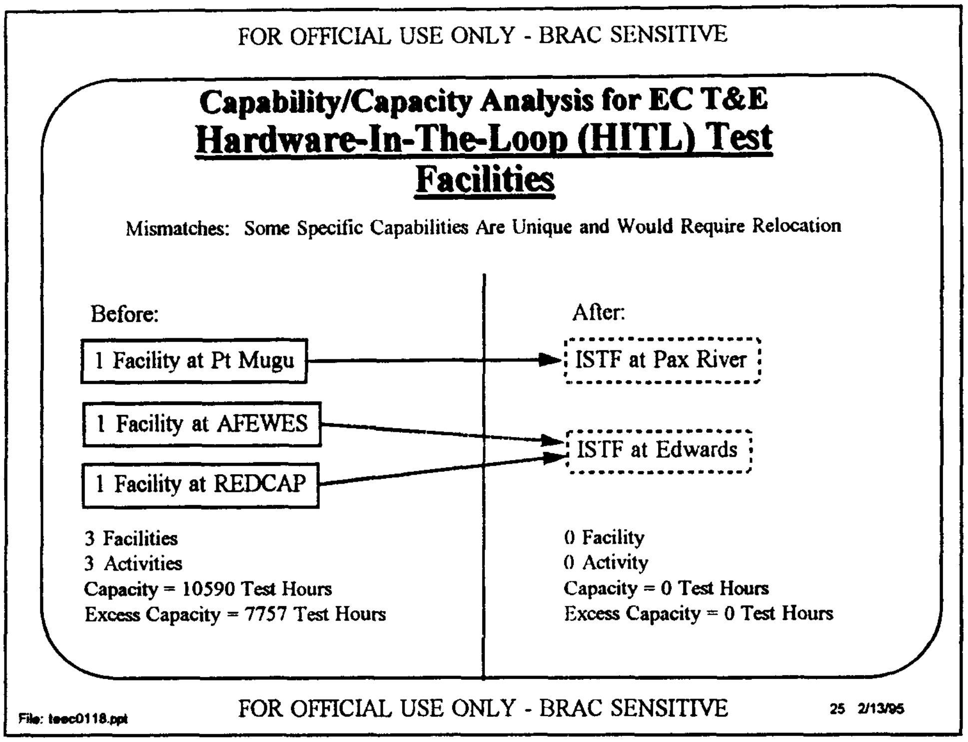
This proposed realignment is recommended as a "core alternative". It was suggested by the optimization model but not supported by the JCSG as it involves realigning workload from a core T&E activity. It would not, however, require the relocation of any resources and offers significant potential savings.




There are currently three facilities doing integration laboratory work in support of EC, all three of which are located at core T&E activities. Together, these three facilities generate a large capacity, approximately 37% of which is excess to projected workload requirements.

Although NAWC Pt Mugu has a higher EC T&E functional value than NAWC China Lake or AFFTC Edwards, Pt Mugu does not have the capacity to absorb the integration laboratory workload from either China Lake NAS or Edwards AFB. Either of the latter facilities can, however, accommodate all EC integration laboratory workload from Pt Mugu NAS, allowing a reduction in the number of both facilities and activities involved in EC T&E by one each (all EC T&E workload would be realigned from NAWC Pt Mugu under this and following proposals).

This proposed consolidation is included in the "other core realignments" category as the integration laboratory at NAWC Pt Mugu does work in other functional areas and impacts thereto may not yet be known. Additionally, integration laboratories are typically quite weapons system-specific (NAWC China Lake support primarily antiradiation missiles; AFFTC Edwards supports F-15, F-16, and F-22 systems; and NAWC Pt Mugu supports mostly other aircraft avionics). Although an admirable goal, consolidating these capabilities may be difficult.

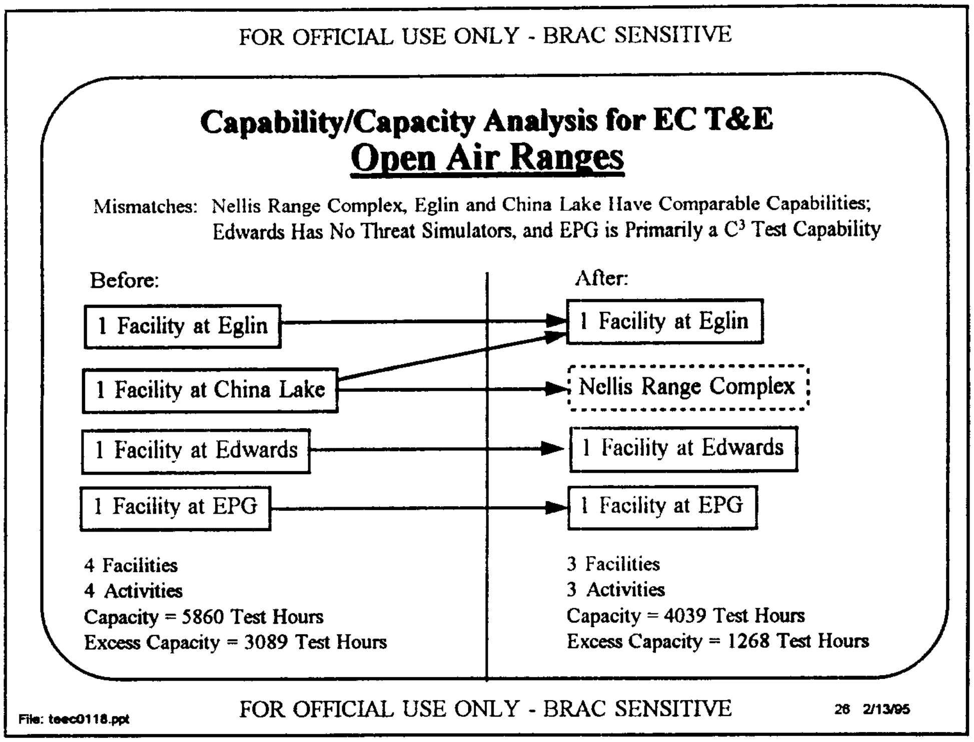



There are currently three facilities doing hardware-in-the-loop testing in support of EC, one of which (NAWC Pt Mugu) is located at a core T&E activity. Together, these three facilities generate a very large capacity, 73% of which is excess to projected workload requirements.

Although HITL testing fills a vital niche in the EC Test Process, such work need not be performed in facilities separate and distinct from installed systems test facilities (ISTFs). In fact, collocating HITLs and ISTFs would not only save funds; it would also enhance implementation of the Test Process by improving the correlation of test results and allowing a more complete evaluation of integrated systems and avionic suites. Expensive hybrid threat simulators could be shared.

Collocating HITL and ISTF capabilities would reduce the number of facilities (by two) and activities (by three) involved in electronic combat T&E, and decrease excess capacity by 10,590 hours. Additionally, ISTF workload would increase (thus reducing excess capacity in this test facility category, as well).

Realignment of EC T&E workload from AFDTC REDCAP was suggested by the optimization model and supported by the JCSG as alternative TE-1 (EC). Realignment of T&E workload from AFEWES was also recommended by the JCSG [as alternative TE-2 (EC)], as AFEWES is not located at a core T&E activity. NAWC Pt Mugu is a core T&E activity, so moving workload therefrom was not addressed by the JCSG. However, consolidating all HITL capabilities at ISTFs would produce significant savings and focus EC ground test capabilities at MRTFB activities having open air ranges.




This chart discusses realignment opportunities within the EC OAR test facility category. EC T&E OAR capabilities at the Nellis Range Complex, AFDTC Eglin, and NAWC China Lake, although not entirely duplicative, have approximately 85% overlap. Projected workload figures suggest that DoD would be well served by realigning workload from one EC OAR thus reducing the number of similar facilities from three to two. Following the rules of moving workload to the higher functional value, as well as for capability and capacity purposes, such workload should be realigned from NAWC China Lake. As the primary receiver site, the Nellis Range Complex would absorb most of the OAR workload from China Lake. The remainder of China Lake's EC OAR workload could be easily accommodated at AFDTC Eglin. The only assets that would require transfer under his scenario are simulators representing sea-based threat systems, which would be relocated to a more realistic littoral environment (one with real land/water contrast) at Eglin AFB.

EC OAR testing done at AFFTC Edwards is done primarily in conjunction with either other functional area testing (air vehicle/avionics) as for example, testing done in conjunction with a nearby range. Edwards AFB does not possess threat-specific simulators typically associated with EC OAR testing, and thus is not duplicative of the Nellis Range Complex, Eglin, or China Lake.

EPG's OAR testing primarily involves C3 work. This workload is also not duplicative of that done at other T&E facilities.

Consolidating three primary EC OARs into two would reduce the number of activities and facilities involved in EC testing, reduce excess capacity in this TFC by 59%, save I&M and O&M funds, and concentrate threat simulators into more realistic signal and pulse environments for testing.

## Optimization Model Output (Test Hours) Adjusted

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| **AFDTC, Eglin AFB** | 65 | | 2390 | | | 761 | 963 |
| **NAWC, Pt Mugu** | 58 | | 487 | 459 | 309 | | |
| **NAWC, Pax River** | 53 | | 0 | | | 2843 | |
| **AFFTC, Edwards AFB** | 52 | | | 3088 | | | 758 |
| **NAWC, China Lake** | 47 | | 0 | 1770 | | | 0 |
| **EPG** | 47 | 246 | 1006 | | | | 369 |
| **AFDTC, Holloman** | 29 | | 8402 | | | | |
| AFDTC, AFEWES | 17 | | | | 2524 | | |
| NSWC, Crane | 17 | | 4344 | | | | |
| AFDTC, REDCAP | 15 | | | | 0 | | |

1 Activities and 4 Facilities Realigned

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Although optimization model outputs suggested that workload could be realigned from two EC T&E activities and six facilities, some of these realignments cannot be readily accomplished. Workload from some integration laboratories, for example, cannot be readily accommodated at others due to their weapons system specific nature. Capability mismatches also occur frequently across subcategories of measurement facilities.

Additionally, the optimization model allocated workload to those activities having the highest functional value until all capacity was filled. Then, capacity existing at the activity with the next highest functional value was utilized until it was completely filled, and so forth. Thus, conditions exist in which some, but not all, EC T&E workload was realigned from a facility. Realizing it is very unlikely that some workload will be relocated from a facility which will continue to perform EC T&E, each facility not recommended for total workload realignment was allocated (in the adjusted output) at least the workload it was projected to support under today's baseline.

When adjusted for difficult and partial workload realignments, optimization model outputs identified opportunities for realignment of all workload from four EC T&E facilities, including one activity.

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# Potential Realignments

| Test Facility Category | Facilities | Optimization Model |
|---|---|---|
| MF - Communications | 2 to 1 | Yes |
| MF - Environmental | 2 to 1 | Yes |
| MF - Electromagnetic | 2 to 1 | No |
| MF - RCS | 2 to 1 | Yes |
| Integration Laboratory | 3 to 2 | Yes |
| Hardware-In-The-Loop | 3 to 1 | Yes |
| Open-Air-Range | 4 to 3 | Yes |
| **Total** | **18 to 10** | |

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Analysis of those test facility categories and subcategories possessing significant excess capacity and multiple facilities yields several opportunities for realignment. These opportunities, when considered along with capability and capacity matches, result in eight (two in the HITL TFC) potential realignments in the EC T&E functional area. Of these eight potential realignments, six were identified by the optimization model. The MF-electromagnetic environmental effects realignment and one of the HITL realignments (AFDTC, AFEWES) were not identified as potential opportunities by the optimization model as, in these instances, TFC boundaries must be crossed to allow projected workload to be accommodated. These potential realignments are discussed in more detail on upcoming charts.

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# Outline

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In addition to the capability and capacity analysis, major DoD EC test requirements that impact where test capabilities are located were considered. The next series of charts addresses these requirements and their analysis.

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# DoD Requirements Analysis EC T&E

- Realigned DoD Electronic Combat Structure Must:
  - Meet DoD Weapons System Requirements for Electronic Warfare
  - Meet Policy Imperatives
    - Retain Critical Air/Land/Sea Space
    - Maintain Topographical Diversity
    - Support Total Electronic Warfare Test Process
    - Focus Ground Facilities at MRTFB Open Air Ranges
    - Minimize Single Point Failures (to Extent Cost Effective)
  - Provide Capacity to Handle FY2001 Projected Workload
- Therefore, Realign Open Air Ranges First
  - Highest T&E Cost (Approximately 70%)
  - Establish Predominant Gaining Locations for T&E Ground Facility Workload

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The electronic combat (EC) T&E analysis was conducted under five policy imperatives, as shown on this chart. The analysis focused on realignment of EC open air ranges (OARs) first, as significant excess capacity exists in this test facility category and these facilities typically have the highest costs [both improvement and modernization (I&M) and operations and maintenance (O&M)]. Additionally, since JCSG policy directed maximum consolidation to MRTFB activities having an open air range, realignment of ground test facilities was dependent upon where OAR capabilities were to be located.

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# DoD Requirements Analysis
# EC T&E

| Open Air Range Requirements | AFDTC Eglin | AFFTC Edwards | NAWC China Lake | EPG |
|---|---|---|---|---|
| Airspace = 490,000 sq nm | P | P | P | P |
| DoD Land Space = 100,000 sq nm | P | P | P | P |
| Sea Space = 122,500 sq nm | P | NONE | NONE | NONE |
| Min Straight Line Segment = 300 nm | F | P | P | P |

AFDTC Eglin (Added to the Nellis AFB Range Complex) Best Satisfies DoD Air/Land/Sea Space Requirements

F = Fully Meets Requirements, P = Partially Meets Requirements

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This chart depicts the relative abilities of electronic combat open air ranges to meet DoD air, land, and sea space requirements. These requirements were generated by a supplemental data call by the T&E JCSG (Reference 11). As previously stated, the JCSG approved the Nellis Range Complex as the primary EC open air range; AFDTC Eglin has relative advantages over the other T&E activities possessing an EC OAR.

Eglin AFB and NAWC China Lake have comparable technical capabilities. However, from a natural (and unmoveable) resource perspective, Eglin offers both sea and land space (and thus a realistic littoral test environment) and can accommodate the minimum straight-line segment required for EC testing. Combined with the Nellis Range Complex, consolidating excess EC OAR work at Eglin AFB would provide the most realistic test environment, retain an EC range near each Service's major air vehicle/avionics test center (Edwards AFB and Patuxent River NAS) for easy access, enable a single Service to manage all EC OAR test resources to allow optimum deployment of critical assets for maximum test realism, and save the most I&M and O&M funds as fewer resources would need to be transferred (compared to consolidating at China Lake NAS).

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# DoD Requirements Analysis
# Electronic Combat T&E

| Topography | AFDTC Eglin | AFFTC Edwards | NAWC China Lake | EPG |
|---|---|---|---|---|
| Desert | | X | X | X |
| Mountains | | X | X | X |
| Forest | X | | | |
| Swamp | X | | | |
| Riverine | X | | | |

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Each EC open air range offers a set of natural attributes, including topography, obviously derived from the facility's physical location. Most open air ranges contain desert and mountainous topography (including the Nellis Range Complex), but few offer forest, swamp, or riverine surface area. Thus, from both the air/land/sea space and topography perspectives, a combination of the Nellis range and AFDTC Eglin (as the two primary EC OARs, with AFFTC Edwards and EPG considered specialty sites) provides the optimum test capability.



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# Outline

- EC T&E Baseline
- Optimization Model Outputs
- Capability/Capacity Analysis
- DoD Requirements Analysis
- Alternatives
- Summary

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The capability and capacity analysis, when combined with the DoD requirements analysis, led to the identification of several potential realignment opportunities. These alternatives will be addressed in the next section of the briefing.

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**Electronic Combat T&E**

## Alternatives

- Non-Core (T&E JCSG) Alternatives
- Core Alternatives
  - Core-1 (EC): OAR
  - Core-2 (EC): RCS MF
- Additional Core Alternatives
  - Communications MF
  - Environmental Effects MF
  - Signature Measurement MF
  - Integration Laboratory
  - Hardware-In-The-Loop
  - Open Air Range

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The three general categories of recommended EC T&E realignments are non-core (JCSG), core, and additional core alternatives. There are three recommended realignments in the first category, two core alternatives, and six additional core alternatives. The test facility categories affected by the core and additional core alternatives are shown on this chart.

Each of the three general categories of recommended realignments will be addressed in this section of the briefing, beginning with the three non-core (JCSG) alternatives as detailed on the next chart.



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## JCSG Alternatives

- TE-1 (EC) Realign All EC T&E Work from AFDTC REDCAP
- TE-2 (EC) Realign All EC T&E Work from AFDTC AFEWES
- TE-3 (EC) Realign All EC T&E Work from NSWC Crane

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The three non-core (JCSG) alternatives pertaining to the EC T&E functional area are shown on this chart. The first two impact Air Force hardware-in-the-loop test facilities; the third realigns workload from a Navy electromagnetic environmental effects measurement facility.

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## Potential Realignments

| Test Facility Category | Facilities | Optimization Model | JCSG Alternatives |
|---|---|---|---|
| MF - Communications | 2 to 1 | Yes | No |
| MF - Environmental | 2 to 1 | Yes | No |
| MF - Electromagnetic | 2 to 1 | No | TE-3 (EC) |
| MF - RCS | 2 to 1 | Yes | No |
| Integration Laboratory | 3 to 2 | Yes | No |
| Hardware-In-The-Loop | 3 to 1 | Yes | TE-1 (EC)<br>TE-2 (EC) |
| Open-Air-Range | 4 to 3 | Yes | No |

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The first category of recommended realignments are those developed by the Joint Cross Service Group (JCSG). By JCSG policy, these recommended realignments are all non-core in nature (none involve relocating workload from a core T&E activity).

The three JCSG alternatives affecting the electronic combat functional area are shown in the right-hand column on this chart. All of the potential realignments identified by the optimization model but not endorsed by the JCSG failed to obtain JCSG support simple because they entailed realigning workload from core T&E activities.

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# JCSG Alternatives
## Capacity Fit

| Activity | Functional Value | MF | HITL | ISTF |
|---|---|---|---|---|
| TE-1 (EC) | | | | |
| - AFDTC, REDCAP | 15 | | 86 | |
| + AFFTC, Edwards [1)] | 52 | | | 86 |
| TE-2 (EC) | | | | |
| - AFDTC, AFEWES | 17 | | 2524 | |
| + AFFTC, Edwards [1)] | 52 | | | 2524 |
| TE-3 (EC) | | | | |
| - NSWC, Crane | 17 | 4344 | | |
| + EPG | 47 | 1041 | | |
| + NAWC, Pax River [2)] | 53 | | | 3303 |

1) BAF Excess Capacity: 964 HRS EC + 1968 HRS AV = 2932 Total
2) ACETEF Excess Capacity: 1707 HRS EC + 4566 HRS AV = 6273 Total

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This chart indicates where workload would move from and to if the non-core (JCSG) alternatives are implemented. It is important to note that workload is being transferred across test facility categories in each of these instances. Hardware-in-the-loop workload from both AFDTC REDCAP and AFDTC AFEWES would be realigned to the Avionics Test and Integration Complex (ATIC) at AFFTC Edwards. The ATIC is an existing facility which, although excluded during the JCSG analysis due to low EC T&E workload the past two years, has significant excess capacity. (Across the EC and air vehicle functional areas, the ATIC has 2932 hours of excess capacity.) This excess capacity is becoming increasingly valuable as ATIC EC test capabilities are upgraded via the Electronic Combat Integrated Test program. Under these alternatives, only those HITL capabilities absolutely required would be relocated; those redundant to capabilities existing elsewhere or with little customer demand would not be moved.

The electromagnetic environmental effects measurement workload from NSWC Crane is recommended for realignment to EPG. However, EPG does not have the capacity to accommodate all of the workload from NSWC Crane, so the majority would be realigned to the Air Combat Environment Test and Evaluation Facility (ACETEF) at NAWC Patuxent River. The ACETEF, in addition to having an anechoic chamber, possesses a ramp area which is already capable of conducting electromagnetic environmental effects testing. Across the EC and air vehicle functional areas, the ACETEF has 6,273 hours of excess capacity available.

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# JCSG Alternatives
## Capability Fit

- TE-1 (EC): Realign HITL Work from AFDTC, REDCAP to ISTF at AFFTC, Edwards
  - Basic HITL and ISTF Instrumentation is Similar
  - REDCAP Workload Involves only Approximately 50% of REDCAP's Capabilities
    - Only These Capabilities Would be Transferred
  - Improves Testing of Integrated Avionics
  - Moves Workload to a Core Activity and Near a MRTFB OAR
  - Reduces Number of EC T&E Activities by One
  - Increases Average FV for EC T&E Activities from 40 to 42

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This chart addresses the ability of the Avionics Test and Integration Complex at AFFTC Edwards to support the work currently performed at AFDTC REDCAP, and describes the results of realigning all workload from the latter to the former.

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# JCSG Alternatives
## Capability Fit

- TE-2 (EC): Realign HITL Work from AFDTC, AFEWES to ISTF at AFFTC, Edwards
  - Basic HITL and ISTF Instrumentation is Similar
  - Most AFEWES Work Involves only Approximately 65% of AFEWES' Capabilities
    - Only These Capabilities Would be Transferred
  - Improves Testing of Integrated Avionics
  - Moves Workload to a Core Activity and Near a MRTFB OAR
  - Reduces Number of EC T&E Activities by One
  - Increases Average FV for EC T&E Activities from 42 to 46

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This chart addresses the ability of the Avionics Test and Integration Complex at AFFTC Edwards to support the work currently performed at AFDTC AFEWES, and describes the results of realigning workload from the latter to the former.

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## JCSG Alternatives
### Capability Fit

- TE-3 (EC): Relocate Electromagnetic Environmental Effects Measurement Facility Work from NSWC, Crane to the Electronic Proving Ground and the ISTF at NAWC, Patuxent River
  - EPG and NAWC, Pax River Already Do Electromagnetic Environmental Effects Testing (Only Moves Workload)
  - Moves Workload to a Core Activity and Near a MRTFB OAR
  - Reduces Number of EC T&E Activities by One
  - Increases Average FV for EC T&E Activities from 46 to 50

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This chart addresses the abilities of EPG and NAWC Patuxent River to support all of the EC T&E work currently performed at NSWC Crane, and describes the results of realigning workload from the latter to the two former facilities.

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# Workload Summary (Test Hours)
## JCSG Alternatives

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| AFDTC, Eglin AFB | 65 | | 2390 | | | 761 | 899 |
| NAWC, Pt Mugu | 58 | | 487 | 459 | 223 | | |
| NAWC, Pax River | 53 | | 148 | | | 6146 | |
| AFFTC, Edwards AFB | 52 | | | 3088 | | 2610 | 758 |
| NAWC, China Lake | 47 | | 2311 | 1770 | | | 745 |
| EPG | 47 | 246 | 1899 | | | | 369 |
| AFDTC, Holloman | 29 | | 6091 | | | | |
| AFDTC, AFEWES | 17 | | | | 0 | | |
| NSWC, Crane | 17 | | 0 | | | | |
| AFDTC, REDCAP | 15 | | | | 0 | | |

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Implementation of the non-core (JCSG) alternatives would increase the average functional value for EC T&E activities from 40 to 50, as the three lowest-ranking activities would be realigned. This chart summarizes the resulting workload distribution. It is apparent that the workload at AFDTC AFEWES, NSWC Crane, and AFDTC REDCAP has been realigned to AFFTC Edwards, EPG, and NAWC Patuxent River. (Changes to the baseline workload distribution are highlighted by the boxes.)

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# EC T&E Workload & Capacity JCSG Alternatives (Hours/Year)

| Service | Activites | Facilities | Capacity (Test Hours) | Projected Workload (Test Hours) | Excess Capacity (Test Hours) | % Reduction in Excess Capacity |
|---|---|---|---|---|---|---|
| Air Force | 3 | 9 | 30,820 | 16,597 | 14,223 | 35% |
| Navy | 3 | 8 | 16,544 | 12,289 | 4,255 | 46% |
| Army | 1 | 5 | 5,280 | 2,514 | 2,766 | 27% |
| Total | 7 | 22 | 52,284 | 31,400 | 21,244 | |
| % Reduction from Baseline | 30% | 8% | 19% | -- | 37% | |

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If all three non-core (JCSG) alternatives are implemented, overall excess capacity within the EC T&E functional area would decrease 37 percent. Additionally, the number of facilities and activities supporting EC T&E would decrease eight and 30 percent, respectively. The boxes on this chart highlight the values that have changed since the baseline.

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# EC T&E Capacity Analysis
## JCSG Alternatives

| Test Facility Category | Number Facilities | Workload (Test Hours) | Excess Capacity (Test Hours) |
|---|---|---|---|
| Digital Models and Simulations | 1 | 246 | 764 |
| MF - Communications | 2 | 298 | 928 |
| MF - Environmental | 2 | 2174 | 3257 |
| MF - Electromagnetic | 1 | 1626 | 0 |
| MF - Guidance | 1 | 1728 | 672 |
| MF - Static RCS | 2 | 6674 | 7089 |
| MF - Signature Measurement | 2 | 826 | 690 |

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Implementing all three of the non-core (JCSG) alternatives would reduce EC T&E excess capacity in electromagnetic environmental effects measurement facilities (MFs), hardware-in-the-loop (HITL) test facilities, and installed systems test facilities (ISTFs). [Although no ISTF capacity was eliminated, transferring MF and HITL workload to ISTFs (and eliminating MF and HITL capacity) effectively reduces excess capacity in all three test facility categories.] Again, boxes highlight values that have changed since the baseline was established.

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# EC T&E Capacity Analysis
## JCSG Alternatives
**(Cont'd)**

| Test Facility Category | Number Facilities | Workload (Test Hours) | Excess Capacity (Test Hours) |
|---|---|---|---|
| Integration Laboratory | 3 | 5317 | 3117 |
| Hardware-In-The-Loop | 1 | 223 | 197 |
| Installed Systems Test Facility | 3 | 9517 | 1441 |
| Open air Range | 4 | 2771 | 3089 |

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# Potential Realignments

| Test Facility Category | Facilities | Optimization Model | JCSG Alternatives | Core Alternatives | Remarks |
|---|---|---|---|---|---|
| MF - Communications | 2 to 1 | Yes | No | No | More Than EC T&E |
| MF - Environmental | 2 to 1 | Yes | No | No | More Than EC T&E |
| MF - Electromagnetic | 2 to 1 | No | TE-3 (EC) | - | |
| MF - RCS | 2 to 1 | Yes | No | Core-2 (EC) | |
| Integration Laboratory | 3 to 2 | Yes | No | No | Weapon Sys Specific |
| Hardware-In-The-Loop | 3 to 1 | Yes | TE-1 (EC)<br>TE-2 (EC) | - | |
| Open-Air-Range | 4 to 3 | Yes | No | Core-1 (EC) | |

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Since the JCSG working group was not allowed to recommend realignment of any workload from any core T&E activity, several potential consolidations suggested by the optimization model were not addressed in the non-core alternatives. Specifically, significant excess capacity was allowed to remain in static radar cross section (RCS) measurement facilities and EC open air ranges, two of the most expensive test facility categories to build, operate and maintain.

Realignments in three other test facility categories (TFCs) were also suggested by the model but not addressed by the JCSG alternatives. These TFCs (communications and environmental effects measurement facilities, and integration laboratories) certainly offer opportunities for additional reductions in facilities, activities, and excess capacity, they will not be as easy to realign as RCS MFs and OARs. Also, they do not offer the payback associated with the latter two test facility categories. Rationale is shown in the "remarks" column on this chart.

Because of expected savings, open air ranges and RCS measurement facilities are addressed next as core alternatives 1 (EC) and 2 (EC), respectively.

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# Capability/Capacity Analysis
## EC OARs

- Basic Requirement: Capability to Conduct Open Air Testing (Both Airborne and Ground-Based) Against a Modern, Integrated and Realistic Array of Ground, Sea and Air-Based Threat Systems

| Activity | Functional Value | Meets Req'mt | Capacity (Test Hours) | Workload (Test Hours) | Excess Capacity (Test Hours) |
|---|---|---|---|---|---|
| AFDTC, Eglin | 65 | Partial | 1978 | 899 | 1079 |
| AFFTC, Edwards | 52 | No [1)] | 1200 | 758 | 442 |
| NAWC, China Lake | 47 | Partial | 1821 | 745 | 1076 |
| EPG | 47 | No [2)] | 861 | 369 | 492 |

Notes: 1) Limited Stand-Alone EC OAR Test Capability
2) Primarily a C3 Test Capability

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Per JCSG guidelines, the basic requirement for an EC open air range is basically defined as that which exists today (albeit somewhat distributed). This requirement, as described on the top of this chart, encompasses all types of threats including associated command and control systems. The term "realistic" in the definition also relates to the types and number of threat systems available to test against, and their deployment.

There are four EC open air ranges included in the JCSG analysis; they are shown here, along with their associated T&E functional values, capacities, and workloads. Additionally, the Nellis Range Complex has an EC test capability that was evaluated at a top level by the JCSG. The JCSG agreed that the Nellis Range Complex would be the primary receiver site for EC OAR workload. AFDTC Eglin and NAWC China Lake have capabilities comparable to, but generally less capable than, the Nellis Range. Thus, there are basically three similar EC OARs being operated and maintained by the Services, each of which is approximately 55 percent utilized.

AFFTC Edwards has an EC OAR, but it is a very basic capability (no threat-specific threat simulators are located here) used in conjunction with other assets to test avionic systems. Likewise, the EC OAR at EPG is not comparable to that at Nellis, Eglin, or China Lake because the former focuses primarily on blue command, control and communications (C3) systems testing. Comparing the latter three EC OARs, each has a partial capability to meet the basic requirement as defined. However, the Nellis Range Complex has the best capability, followed in order by AFDTC Eglin and NAWC China Lake.

Eglin also has a higher functional value than China Lake. Thus, in terms of cost and capability, DoD would be well served if EC OAR workload were realigned from NAWC China Lake to the Nellis Range Complex. Sea based threats should be deployed to AFDTC Eglin, where a realistic littoral test environment (one with real sea/land interface) exists. Consolidating EC OAR workload at Nellis and Eglin would significantly reduce excess capacity and save funds, result in an EC range near the Services' major aircraft/avionics test activities (Edwards AFB and Patuxent River NAS), produce a more realistic test environment (better natural attributes and more concentrated technical capabilities), and reduce the number of facilities involved in EC T&E.

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## Capability/Capacity Analysis
## Static RCS Measurement Facilities

- Basic Requirement: Capability to Conduct Static RCS Measurements at Selected Frequencies and with the Required Sensitivity

| Activity | Functional Value | Meets Req'mt | Capacity (Test Hours) | Workload (Test Hours) | Excess Capacity (Test Hours) |
|---|---|---|---|---|---|
| NAWC, China Lake | 47 | Partial (1) | 3843 | 2311 | 1532 |
| AFDTC, Holloman | 29 | Full | 9920 | 4363 | 5557 |

Notes: (1) Capability is Basically Equivalent to the Lesser of the two RCS Measurement Facilities at Holloman

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The same type of analysis can be applied to static radar cross section (RCS) measurement facilities. The basic requirement (as defined by the capabilities existing today) is described at the top of this chart. As previously mentioned, both the Radar Target Scatter (RATSCAT) capability and the RATSCAT Advanced Measurement System (RAMS) exist at AFDTC Holloman, the latter being a significant improvement over the former. NAWC China Lake has only the Junction Ranch RCS Measurement Facility, which is comparable to the RATSCAT. Thus, although AFDTC Holloman has both the capability and capacity to absorb the RCS measurement facility workload from China Lake, the reverse is not true. It would be economically beneficial to concentrate static RCS measurement workload at AFDTC Holloman, and it would decrease the number of facilities involved in EC T&E.

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## Core Alternatives

- Core-1 (EC) EC OAR Workload from NAWC, China Lake to Nellis Range Complex and AFDTC, Eglin AFB
- Core-2 (EC) EC RCS MF Workload from NAWC, China Lake to AFDTC, Holloman

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The above analysis of the open air range and radar cross section measurement facility TFCs leads us to the two core alternatives summarized on this chart. Scenarios and basic rationale for implementing these alternatives are shown on the next three charts, with a savings summary on the fourth.

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## Alternative Core-1 (EC)

- Scenario: Move the Electronic Combat Open Air Range T&E Work Currently Accomplished in the Electronic Combat Facility at China Lake NAS, CA to the Nellis Range Complex and the Electromagnetic Test Environment at Eglin AFB, FL
- Rationale:
  - EC OARs are Difficult and Expensive to Maintain in a Current, Modern Configuration
    - ECR O&M Costs $8.3M/Year
    - Consolidation Would Enable $66M Savings of Planned I&M
  - AF Has Considerably More EC OAR Test Capability, Workload, and Capacity than does Navy
  - Conforms to Results of 5 out of 6 Optimization Model Runs
  - Eglin Has a Substantially Higher (the Highest) EC T&E Functional Value than does China Lake (65 vs 47)

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As mentioned, alternative Core-1 (EC) involved realigning EC open air range workload from the Electronic Combat Range at NAWC China Lake to the Nellis Range Complex and the Electromagnetic Test Environment at AFDTC Eglin. All possible workload would transfer to the Nellis range, and only eleven sea based threat simulators would be relocated.

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# Alternative Core-1 (EC)
**(Cont'd)**

- Rationale (Cont'd):
  - Reduces the Number of EC OARs from 3 to 2
  - Consolidation at Nellis and Eglin Would Retain Environmental Diversity for EC Testing (Desert and Sea/Forest vs Desert only)
  - Retains an EC OAR Near Both Primary Air Vehicle/Avionics Test Activities
  - Eglin Can Provide a Realistic Littoral Test Environment
  - Would Provide Optimum Threat and Signal Density Environment for Test and Evaluation
  - Nellis and Eglin Have Available Capacity and Basic Infrastructure to Absorb All EC OAR Work from China Lake
  - Eglin Has More Test Capability than Does China Lake
    - 57 Threat Simulators vs 44
    - Only 11 Sea Based Threats Would be Relocated

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## Alternative Core-2 (EC)

- Scenario: Move the Electronic Combat Radar Cross-Section Measurement T&E Work Currently Accomplished in the Junction Ranch Facility at China Lake NAS, CA to the Radar Target Scatter Facility at Holloman AFB, NM
- Rationale:
  - AF Has Considerably More Static RCS Measurement Capability, Workload, and Capacity than does Navy
  - Conforms to Results of 4 out of 5 Optimization Model Runs
  - Reduces the Number of Activities Involved in EC RCS Measurement from Two to One
  - Holloman Has Available Capacity and Capability to Absorb all EC RCS Measurement Work from China Lake
  - Holloman Has Both Basic and Advanced RCS Measurement Facilities
    - China Lake has Only Basic Facilities

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Alternative Core-2 (EC) is the recommended realignment of static radar cross section measurement facility workload from NAWC China Lake to AFDTC Holloman. The rationale is as shown on this chart.

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## BRAC Criteria IV & V

| | 1-Time Cost ($M) | 20 YR NPV ($M) | Steady State Savings | ROI (Years) | Pers Savings |
|---|---|---|---|---|---|
| OAR | 7.4 | 129.8 | 11 | 0 | 108 |
| RCS | 0.3 | 13.7 | 0.9 | 0 | 16 |

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Realignment of EC OAR workload from NAWC China Lake would entail a one-time cost of $7.4 million, but this amount would be more than repaid within the first year. Net savings from reducing from three to two primary EC ranges in this manner would be almost $130 million over twenty years, with $11 million per year recurring. Additionally, 108 government manpower positions would be saved.

Realignment of static RCS measurement facility workload from NAWC China Lake would also produce an immediate payback. The one-time cost would be $0.3 million, followed by almost $14 million is savings over twenty years and $0.9 million recurring savings per year. Sixteen government manpower positions would be saved by this consolidation.

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## Workload Summary
## Core Alternatives
## (Test Hours)

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| AFDTC, Eglin AFB | 65 | | 2390 | | | 761 | 963 |
| NAWC, Pt Mugu | 58 | | 487 | 459 | 223 | | |
| NAWC, Pax River | 53 | | 148 | | | 6146 | |
| AFFTC, Edwards AFB | 52 | | | 3088 | | 2610 | 758 |
| NAWC, China Lake | 47 | | 0 | 1770 | | | 0 |
| EPG | 47 | 246 | 1899 | | | | 369 |
| AFDTC, Holloman | 29 | | 8402 | | | | |
| AFDTC, AFEWES | 17 | | | | 0 | | |
| NSWC, Crane | 17 | | 0 | | | | |
| AFDTC, REDCAP | 15 | | | | 0 | | |

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Following implementation of alternatives Core-1 (EC) and Core-2 (EC), EC T&E workload would be distributed as shown on this chart. (It is assumed that all three non-core (JCSG) EC T&E alternatives have already been implemented.) The boxes with "0" workload indicate realignments from China Lake, while the other highlighted areas indicate where the workload would be realigned to.

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## EC T&E Workload & Capacity Core Alternatives (Hours/Year)

| Service | Activites | Facilities | Capacity (Test Hours) | Projected Workload (Test Hours) | Excess Capacity (Test Hours) | % Reduction in Excess Capacity |
|---|---|---|---|---|---|---|
| Air Force | 3 | 9 | 30,820 | 18,972 | 11,848 | 46% |
| Navy | 3 | 6 | 10,880 | 9,233 | 1,647 | 79% |
| Army | 1 | 5 | 5,280 | 2,514 | 2,766 | 27% |
| Total | **7** | **20** | 46,980 | 30,719 | **16,261** | |
| % Reduction from Baseline | 30% | 17% | 28% | 2% | 51% | |

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If the three non-core (JCSG) and the two core alternatives are implemented, excess capacity in the T&E functional area would be reduced 51 percent. More importantly, much of this reduction would be realized via realignment of an open air range and a RCS measurement facility, two of the most expensive categories of EC test resources to build, operate, and maintain. Overall, the number of facilities involved in EC T&E would be reduced by 17 percent, the number of activities by 30 percent, and overall capacity by 28 percent. The two percent reduction in projected workload reflects a shift in open air range workload to the Nellis Range Complex.

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# DoD Workload and Capacity Core Alternatives

| Test Facility Category | Facilities | Capacity (Test Hours) | Projected Workload (Test Hours) | Excess Capacity (Test Hours) |
|---|---|---|---|---|
| Digital Models & Simulation | 1 | 1010 | 246 | 764 |
| MF - Communications | 2 | 1226 | 298 | 928 |
| MF - Environmental | 2 | 5431 | 2174 | 3257 |
| MF - Electromagnetic | 1 | 1626 | 585 | 1041 |
| MF - Guidance | 1 | 2400 | 1728 | 672 |
| MF - RCS | 1 | 9920 | 6674 | 3246 |
| MF - Signature Measurement | 2 | 1516 | 826 | 690 |
| Integration Laboratory | 3 | 8434 | 5317 | 3117 |
| Hardware-In-The-Loop | 1 | 420 | 223 | 197 |
| Installed Systems Test Fac | 3 | 10958 | 9517 | 1441 |
| Open Air Range | 4 | 4039 | 2090 | 1949 |
| Total | **20** | 46980 | 30719 | **16261** |

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Looking across test facility categories, it becomes apparent that [even after the non-core (JCSG) and core EC alternatives are implemented] there are still additional opportunities for realignment. Specifically, there are still TFCs having significant excess capacity and more than one facility. The TFCs offering additional consolidation opportunities include environmental effects, communications, and signature measurement facilities; integration laboratories; hardware-in-the-loop test facilities (when considered in conjunction with installed systems test facilities), and open air ranges. Some of these facilities could be readily realigned as they accomplish only EC T&E workload, whereas others cross functional and mission areas. Although some of these realignments may be difficult to implement for technical reasons, all should be reviewed and accomplished where practicable.

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## Additional Core Realignments

- Realign Communications MF from NAWC Pax River to EPG
- Realign Environmental Effects MF from EPG to AFDTC Eglin
- Realign Signature MF from NAWC Pt Mugu to AFDTC Eglin
- Realign IL from NAWC Pt Mugu to NAWC China Lake
- Realign HITL from NAWC Pt Mugu to ISTF at NAWC Pax River
- Realign OAR from EPG to AFFTC Edwards

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The six additional realignments to workload at core T&E activities are listed on this chart. All were described in the capability/capacity analysis section of this briefing with the exception of the open air range consolidation.

This second OAR opportunity (following realignment of EC T&E workload from NAWC China Lake) involves relocating work from EPG to AFFTC Edwards. Edwards AFB has the capacity and general capability to accept EPG's EC OAR workload, but some command, control, and communications (C3) test capabilities would have to be transferred. So doing would further consolidate EC testing, particularly of expensive open air range work, thus reducing the number of facilities so involved and saving I&M and O&M funds.

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## Potential EC T&E Facilities/Capacity

| Test Facility Category | Number Facilities | Workload (Test Hours) | Excess Capacity (Test Hours) |
|---|---|---|---|
| Digital Models and Simulations | 1 | 246 | 764 |
| MF - Communications | 1 | 298 | 710 |
| MF - Environmental | 1 | 2174 | 2482 |
| MF - Electromagnetic | 1 | 1626 | 0 |
| MF - Guidance | 1 | 1728 | 672 |
| MF - Static RCS | 1 | 6674 | 3246 |
| MF - Signature Measurement | 1 | 826 | 0 |
| Integration Laboratory | 2 | 5317 | 2267 |
| Hardware-In-The-Loop | 0 | 0 | 0 |
| Installed Systems Test Facility | 3 | 9740 | 1441 |
| Open Air Range | 2 | 2090 | 1088 |

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The six additional core realignments would affect the number of EC T&E facilities and excess capacity as shown on this chart. (Changes are highlighted by boxes.) In two cases (HITLs and ISTFs), workload figures also changed (decreased and increased, respectively) as workload was shifted from the former type of test facility to the latter. The result of implementing all eleven realignment recommendations would leave a single DoD EC test facility in each TFC with the exceptions of integration laboratories, installed systems test facilities, and open air ranges. In each of these categories, there is insufficient excess capacity to reduce to fewer test facilities.

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# Potential EC T&E Facilities/Capacity
(Cont'd)

| Test Facility Category | Number Facilities | Workload (Test Hours) | Excess Capacity (Test Hours) |
|---|---|---|---|
| Integration Laboratory | 2 | 5317 | 2267 |
| Hardware-In-The-Loop | 0 | 0 | 0 |
| Installed Systems Test Facility | 3 | 9740 | 1441 |
| Open air Range | 2 | 2090 | 1088 |

3 Activities and 7 Facilities Realigned

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**Electronic Combat T&E**
**Potential Workload (Test Hours)**

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| **AFDTC, Eglin AFB** | 65 | | 3000 | | | 761 | 963 |
| **NAWC, Pt Mugu** | 58 | | 0 | 0 | 0 | | |
| **NAWC, Pax River** | 53 | | 0 | | | 6369 | |
| **AFFTC, Edwards AFB** | 52 | | | 3088 | | 2610 | 1127 |
| **NAWC, China Lake** | 47 | | 0 | 1770 | | | 0 |
| **EPG** | 47 | 246 | 1924 | | | | 0 |
| **AFDTC, Holloman** | 29 | | 8402 | | | | |
| AFDTC, AFEWES | 17 | | | | 0 | | |
| NSWC, Crane | 17 | | 0 | | | | |
| AFDTC, REDCAP | 15 | | | | 0 | | |

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Workload distribution following implementation of all eleven recommended EC realignments is shown on this chart. Facilities from which all EC T&E work has been realigned are identified by "0" workload remaining. The boxes highlight changes which would result from implementation of the six additional core EC alternatives. Facilities identified by a box enclosing a value other than zero are, again, the recommended receiver sites in the additional core alternatives.

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Potential

**EC T&E Workload & Capacity (Hours/Year)**

| Service | Activites | Facilities | Capacity (Test Hours) | Projected Workload (Test Hours) | Excess Capacity (Test Hours) | % Reduction in Excess Capacity |
|---|---|---|---|---|---|---|
| Air Force | 3 | 9 | 30,918 | 19,951 | 10,967 | 50% |
| Navy | 2 | 2 | 8,827 | 8,598 | 229 | 97% |
| Army | 1 | 3 | 3,644 | 2,170 | 1,474 | 61% |
| Total | **6** | **14** | 43,389 | 30,719 | **12,670** | |
| % Reduction from Baseline | 40% | 42% | 33% | 2% | 62% | |

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Implementation of all eleven recommended realignments would decrease EC T&E excess capacity within DoD by 62 percent, compared to 51 percent for the non-core (JCSG) and primary core alternatives alone. This 11 percent additional reduction in excess capacity, though, may mean considerable savings since these realignments would remove all EC T&E workload from six facilities and one complete activity (NAWC Pt Mugu). Overall, the number of facilities and activities involved in EC T&E would decrease 42 and 40 percent, respectively.

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# Recap
# Electronic Combat T&E

| Option | Activities | Facilities | DoD Capacity (Test Hours) | DoD Excess Capacity (Test Hours) | Comments |
|---|---|---|---|---|---|
| Baseline | 10 | 24 | 64909 | 33501 | |
| Non-Core (JCSG) Alternatives | 7 <30%> | 22 <8%> | 52284 <19%> | 21244 <36%> | Non-Core Realigned |
| Core-1 (EC) (OAR) | 7 <30%> | 21 <12%> | 50463 <22%> | 19744 <40%> | Non-Core Realigned Plus OAR Consolidation |
| Core-2 (EC) (RCS MF) | 7 <30%> | 20 <17%> | 46980 <28%> | 16261 <51%> | Non-Core Realigned Plus OAR & RCS MF Consolidation |
| Add'l Alternatives * | 6 <40%> | 14 <42%> | 43389 <33%> | 12670 <62%> | Core and Non-Core Realigned |

* Maximum Reductions Achievable

<> = % Reduction

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Overall, there are three categories of recommended EC realignment opportunities: non-core (JCSG), core, and additional core alternatives. The numbers of activities and facilities, and associates capacities, are shown in addition to the percent reduction they represent from the baseline. As mentioned, there are three non-core JCSG) recommended realignments, two core alternatives, and six additional core realignment opportunities that affect EC T&E activities. The two core alternatives [Core-1 (EC) and Core-2 (EC)] have potential for easy implementation and to be major cost savers, so are broken out separately on this chart.

The bottom line on this chart represents the results obtainable if all recommended realignments are implemented, and (62 percent) is the maximum reduction in excess capacity possible while maintaining the ability to implement the EC Test Process.

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# Outline

- EC T&E Baseline
- Optimization Model Outputs
- Capability/Capacity Analysis
- DoD Requirements Analysis
- Alternatives
- Summary

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The JCSG-developed analysis plan has thus been completed for the EC T&E functional area, with overall results as shown on the next chart.

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## Summary
## EC T&E Functional Area

- Optimization Model Pointed to 2 Possible Activity Realignments
- JCSG Alternatives Recommend 3 Activities for Realignment
- Reduction in Capacity/Excess Capacity Limited Due to "Core Activity" Approach
- Consolidating at Facility Level Could Yield Additional Savings

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T&E JCSG results of the optimization model pointed to two possible activity realignments: AFDTC REDCAP and NAWC China Lake. The JCSG, in turn, conducted an activity-level analysis and recommended three realignments: AFDTC REDCAP, NSWC Crane, and AFDTC AFEWES. NAWC China Lake was not recommended for realignment by the JCSG as China Lake NAS was designated as a core T&E activity. Restricting realignment of workload from core T&E activities resulted in large, unnecessary amounts of excess capacity being retained. Additionally, the non-core (JCSG) alternatives permit realization of only a fraction of the potential savings identifiable via conducting an analysis at the facility level, as the most expensive test facilities (OARs, for example) typically exist at core activities. Consolidating at the facility level reduces excess capacity an additional 26 percent (and in the most expensive test facility categories) over what the non-core alternatives would accomplish.

5

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# Air Force BRAC '95 Analysis of T&E Infrastructure

Part III: Analysis of RDT&E Alternatives for Armament/Weapons, Explosives, and Propulsion

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Part III of the Air Force analysis developed RDT&E alternatives for armament/weapons, energetics-explosives, and energetics-propulsion.

Primarily, Part III addresses the Laboratory JCSG Chair's RDT&E alternatives as forwarded in the DDR&E Memo #4, dated 29 Nov 94 (Reference 3).

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## Air Launched Weapons RDT&E
## Background

- LJCSG Chair Alternatives (29 Nov 94 Memo #4)
  - Proposes to Consolidate Fixed Wing, Air-Launched (A-A/A-S) Weapons at NAWC (China Lake)
  - AF Did Not Analyze Since Not Developed Jointly and No Supporting Analysis Provided
- OSD(ES) Clarification of DepSecDef's 7 Jan 94 Memorandum (27 Dec 94)
  - Expanded to Include Alternatives Provided by JCSG Chairs (vs Jointly Developed)
- LJCSG Chair Provided Supporting Analysis
  - Conceptual Approach for Integrating Lab (R&D) and T&E JCSG Results
  - Analysis Only Addressed Lab Activities
  - AF Proceeded with Evaluating R&D Portion of Alternatives Only
- Since No T&E Analysis Provided to Support RDT&E Alternative, AF Completed T&E Analysis for "Core" T&E Activities (See Part II)
  - Used Results, Along with LJCSG Data, to Address RDT&E Alternatives

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The LJCSG Chair alternatives in the 29 Nov 94 Memorandum #4 (Reference 3) proposed to consolidate fixed wing, air-launched, air-to-air, and air-to-surface weapons at NAWC (China Lake). The Air Force's initial position was to not analyze these alternatives since they were not developed jointly and no supporting analyses were provided, in accordance with DepSecDef's 7 Jan 94 tasking memo (Reference 1).

OSD (ES) clarified the DepSecDef's policy allowing for any JCSG chair to propose alternatives for consideration by the MilDeps. The AF requested the analysis supporting these alternatives from the LJCSG and the T&E JCSG chairs. Subsequently, the LJCSG Chair provided some supporting analysis for the R&D (Lab) portion of the RDT&E alternatives and the Air Force proceeded in evaluating this portion of the LJCSG Chair's RDT&E alternative.

Since no T&E-specific analyses were provided to the Air Force to support the T&E portion of the RDT&E alternatives, the Air Force used the T&E JCSG results and combined them with further analysis of the LJCSG certified data to address the RDT&E alternatives.


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# LJCSG RDT&E Integration Concept

| | | | | | |
|---|---|---|---|---|---|
| | Labs | | | | T&E Sites |
| | | FV | FC | Load | |
| Common Support Function(s) | | | | | |
| | Lab A | | | | T&E A |
| | Lab B | | | | T&E B |
| | Lab C | | | | T&E C |
| | Lab D | | | | |
| | | | | | |
| Common Support Function | | | | | |
| | Lab A | | | | T&E A |
| | Lab B | | | | T&E B |
| | Lab C | | | | T&E C |
| | | | | | |
| Look Across Sub-Categories (Macro View) | | | | | |

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This chart was extracted directly from the LJCSG Chair's analyses furnished as supporting documentation for the alternatives offered in Memo #4 ( Reference 3). The intent of the chart, as briefed to the LJCSG, was to illustrate the flow of R&D and T&E activities from lower functional values (FV) to higher functional values, and the flow of lower functional value R&D laboratories to higher functional value T&E activities with open air ranges (OAR).

This integration concept is explained further in the following charts.

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## LJCSG RDT&E Integration Concept (Analysis Ground Rules)

- Integrate RDT&E Functions
- Move Lab Activities to T&E Sites Due to Range Space
- Move From Lower to Higher Functional or Military Values
- Roll Up/Look For Activity/Installation Alternatives

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The analyses provided by the LJCSG Chair, as support for the proposed RDT&E alternatives, contained an LJCSG RDT&E integration concept chart (with the following guidelines).

a. integrate RDT&E functions,
b. move lab activities to T&E sites due to range space,
c. move from lower to higher functional or military values, and
d. roll-up/look for activity/installation alternatives.

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## Air Launched Weapons RDT&E Scope

- RDT&E
  - Includes S&T and EMD (Excludes ISE)
- Fixed-Wing A-A/A-G Weapons
  - Surface-to-Surface T&E Excluded
  - Includes 5 CSFs
    - Conventional Missiles and Rockets
    - Guided Projectiles
    - Bombs
    - Guns/Ammo (Added)
    - Cruise Missile
  - Excludes Land, Sea, and Rotary-Wing Launched Weapons
- Lab Activities Include
  - 3 AF (1 Added)
  - 10 Navy (5 Added)
  - 4 Army (All Added)
- Energetics-Explosives Integral Part of Weapons RDT&E

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The LJCSG Chair's alternatives provided in Reference 3 focused exclusively on RDT&E and specifically addressed S&T, EMD, and T&E but excluded reference to in-service engineering (ISE). Although the LJCSG collected R&D data for air-launched, land-launched and sea-launched weapons, the LJCSG Chair narrowed the alternatives by examining "air-launched weapons" going on to define this as "...fixed wing air-to-air and air-to-ground weapons...". Thus, these alternatives addressed four weapons common support functions (CSFs) as follows:

a) conventional missile and rockets
b) bombs
c) guided projectiles
d) cruise missiles

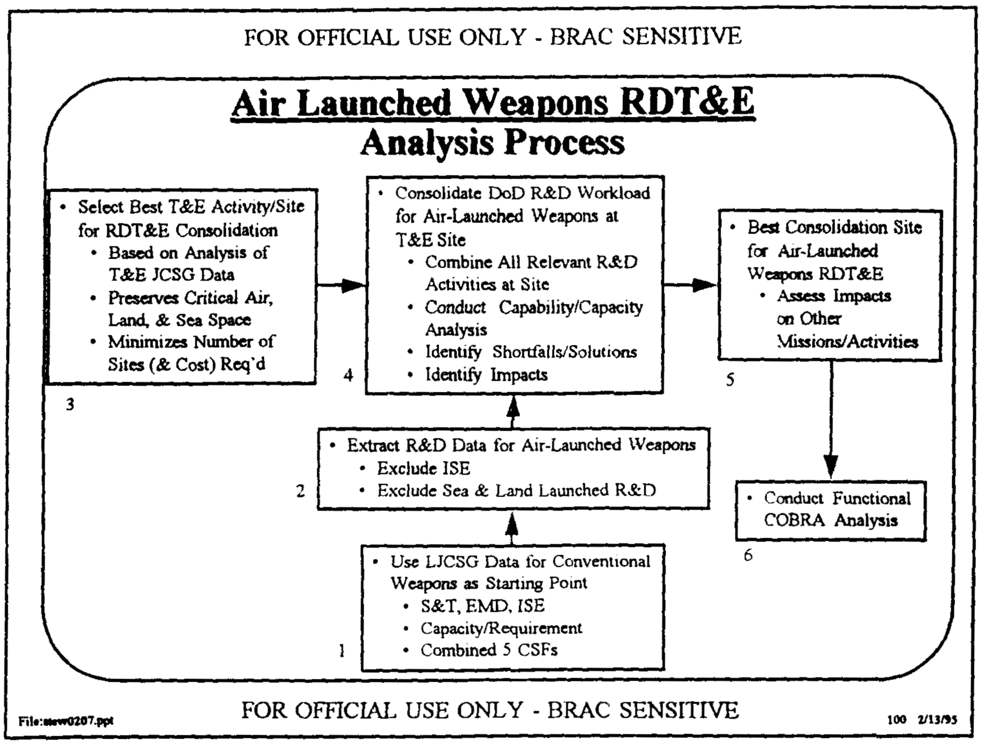
Even though data were collected and analyzed for a fifth CSF (Guns and Ammunition), the LJCSG Chair's alternative did not address this CSF. The alternatives provided by the T&E JCSG addressed air armaments/weapons T&E which included air-to-air, air-to-surface, and surface-to-air but excluded surface-to-surface weapons.

As a result of the above constraints posed by both the LJCSG and T&E JCSG, the Air Force's analysis focused on air-to-air and air-to-ground weapons excluding from analysis, land, sea, and rotary-wing launched weapons. Additionally, LJCSG Memo #4 (Reference 3) also excluded from their analysis several Service organizations. To make the Air Force's analysis complete, these organizations (one for Air Force, five for Navy, and four for Army) were all included to ensure a thorough and accurate comparison.

These organizations are:

| | |
|---|---|
| Air Force | ASC WPAFB, OH |
| Navy | NSWC Dahlgren, VA |
| | NSWC Port Hueneme, CA |
| | NSWC Crane, IN |
| | NSWC Louisville, KY |
| | NSWC RDTE Warminster, PA |
| Army | ARDEC Picatinny Arsenal, NJ |
| | MRDEC Redstone Arsenal, AL |
| | ARL-APG, MD |
| | Benet |

The LJCSG Chair's Memorandum #4 alternatives actually broke the energetics area into three sub areas: propellants, explosives, and pyrotechnics. Energetics-explosives is an integral part of all weapons and consequently, the Air Force did not separately analyze the weapons systems and explosives. Energetics-propellants was analyzed by the Air Force. Energetics-pyrotechnics was not analyzed by the Air Force because the Air Force is not a player in this area.




The process used to analyze the air launched weapons RDT&E is as follows:

Step 1: Initiate the analysis by using the data provided by the LJCSG for weapons. These data considered five CSF's:

a. Conventional missiles/rockets
b. Guided projectiles
c. Bombs
d. Guns/ammo
e. Cruise missiles

For these CSF's, functional capacity and DoD-level functional requirement were available for S&T, EMD, and ISE.

Step 2: Based on the content of LJCSG Chair's Memo #4 (Reference 3) and as stated in the scope, these data were modified by excluding ISE and sea/land launched R&D. This brings the data in direct alignment with the content of Memo #4.

Step 3: Then, the best T&E activity/site was selected for RDT&E consolidation. This selection was based on the T&E JCSG certified data and results for Armament/Weapons. The T&E JCSG analysis preserved critical air, land, and sea space and, through policy imperatives, realigned facilities to open air ranges so as to minimize the number of sites (and cost) required.

Step 4: Using the T&E site from Step 3, evaluate consolidation of the DoD R&D workload for air-launched weapons at that site; that is, combine all relevant R&D activities at the site. For these activities, conduct capability and capacity analyses, identify any shortfalls/solutions, and identify any impacts.

Step 5: Based on the preceding steps, the best site for consolidation of air-launched weapons RDT&E is identified, leaving the assessment of any impacts on other missions/activities to be accomplished.

Step 6: The last step is to conduct a functional COBRA analysis for consolidation to the site selected in Step 5. This step was not addressed due to inadequate data.

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## Air Launched Weapons RDT&E
## *Best T&E Activity/Site

| | Requirement | **AFDTC (Eglin)** | NAWC (China Lake) |
|---|---|---|---|
| Functional Value | | **82** | 57 |
| OAR Capacity (Test Hours) | N/A | **16,036** | 3,986 |
| A/W Flight Tests Per Year | N/A | **582** | 118 |
| Air Space (sq mi) | 50,000 | **93,143** | 19,445 |
| DoD Land Space (sq mi) | (1) 21,000 | **724** | 1693 |
| Sea Space (sq mi) | 50,000 | **91,998** | None |
| Max Straight Line (nm) | A-A = 220 | **(2) 478** | 60 |
| | A-S = 350 | **478** | 60 |
| | S-A = 240 | **(2) 478** | 60 |

Note: (1) No activity meets 21,000 sq mi DoD Land Space Requirement
WSMR's 3,381 sq mi DoD Land Space is max
(2) Includes Theater Missile Defense Capability

* Based on Part II T&E Analysis

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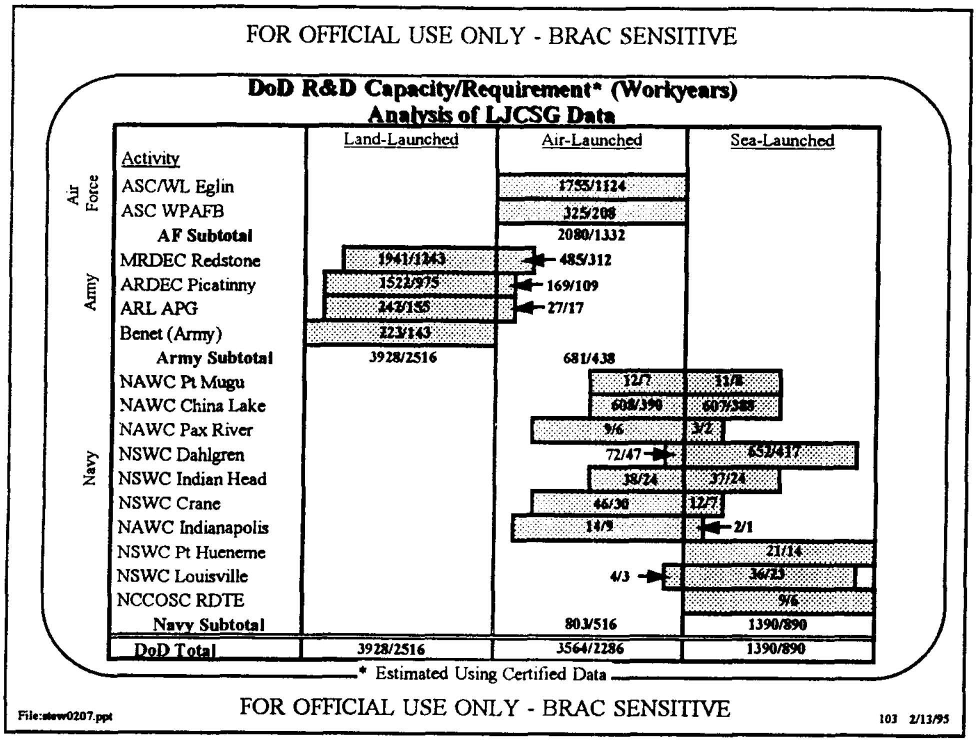
A direct comparison of AFDTC Eglin and NAWC China Lake clearly shows that AFDTC Eglin is the only site capable of meeting the DoD T&E capability and capacity requirements. Eglin's functional value, as computed by the T&E JCSG, is significantly higher than China Lake (82 versus 57). Eglin has four times the capacity of China Lake, and Eglin conducts five times the number of flight tests of China Lake.

Eglin contains both land and sea space at one site, whereas China Lake only provides land space. Eglin provides almost five times the amount of air space as China Lake which can be used to launch live armament/weapons. Although functional value scoring only counted 33,763 square miles of restricted/warning air space and 32,618 square miles of sea space, Eglin includes an additional 59,380 square miles of air and sea space within Eglin Water Test Areas (EWTAs) which Eglin controls for live weapons testing per their agreement with FAA. Further, Eglin can conduct air-to-air, air-to-surface, and surface-to-air tests which require up to a 478 nautical mile maximum straight line segment within the safety footprint. Eglin's safety footprints size also supports Theater Missile Defense and cruise missile T&E. In contrast, China Lake is constrained to a 60 nautical mile straight line segment within their safety footprints which only supports short range air-to-air and air-to-surface weapons.

These results are taken from the T&E JCSG data and results shown in Part II of this report.




As previously discussed under Scope, the content of the LJCSG Chair's Memo #4 (Reference 3) specifically excluded the ISE life cycle and land/sea/rotary-wing launched weapons. This focused the LJCSG Chair's alternatives to R&D air-to-air/air-to-ground weapons launched from fixed-wing platforms (as opposed to rotary-wing). However, all data provided as a part of the LJCSG analysis did not discriminate as to its source; that is, air-launched, land-launched, or sea-launched weapons data. Since the thrust of the LJCSG Chair's alternative was air-launched, the proportions of land/air/sea launched were estimated.

For each activity (2 Air Force; 4 Army; 10 Navy), the functional capacity (FC) for all 16 activities was provided; although FC was not broken down into land/sea/air. The functional requirement (FR), however, was only provided for each CSF and was not broken down to each activity supporting that CSF. To compute the FR value for each activity, it was assumed that the ratio of the FR for the activity in a CSF (FR: activity, CSF) is the same as the ratio of the FC for the activity in a CSF (FC: activity, CSF) to the total FC for a CSF (FC: total, CSF).

The FC: activity, CSF, FC: total, CSF, and FR: total, CSF are known making computation of the FR: activity, CSF possible. With these calculations, the FC and FR is defined for each of the 16 activities. From these FC/FR values the portion of the capacity/requirement directed toward land-launched, air-launched, and sea-launched weapons was derived using the certified BRAC data from all three Services. Using the certified data from each activity, a review was conducted and an estimate was made regarding that activity's involvement in land, air, or sea weapons research and development. This percentage involvement was then used to compute the portion of FC and FR for land, air, and sea-launched weapons. This allowed the creation of a bar graph that shows the involvement of each of the 16 activities in all three areas of weapons R&D: land-launched, air-launched, and sea-launched.

One further clarification can be achieved in accomplishing the analysis of this bar graph. LJCSG Chair Memo #4 specifically addressed air-launched weapons from fixed-wing aircraft. This allows deletion of the Army's R&D air-launched capacity/requirement since their efforts are rotary-wing oriented. This results in an Air Force to Navy comparison in the air-launched weapons area. Using the bar graph composed, analytical comparisons can be made with regards to the capability of different Services/activities to absorb air-launched weapons requirements from across DoD.

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## Air-Launched Weapons RDT&E
### R&D Assessment
### (Functional Requirement/Excess Capacity)

| | Eglin | China Lake | Comments |
|---|---|---|---|
| Before Intra-Service Consolidations | 1124/631 | 390/218<br><br>516/287<br>(Total Navy) | Eglin Can Absorb China Lake<br>- But Not Vice Versa<br>Eglin Can Absorb Total Navy Req't<br>- But Not Vice Versa |
| After Intra-Service Consolidations | 1332/423 | 608/0 | Requires Second Navy Site to Accomodate 798 Work Years to Meet Total Navy Requirement |

Note: - Eglin Has Full R&D Capability (i.e., Collocated Acquisition) vs Partial Capability at China Lake (i.e., Acquisition at Crystal City)
- Even Assuming China Lake 100% Air-Launched, Eglin Short Fall Only 147 Workyears versus 687 for China Lake

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Based on an analysis of this bar graph for land-, air-, and sea-launched weapons, the following can be concluded:

- Before Intra-Service consolidations:

Eglin AFB Functional Requirement (FR) = 1124 Wyrs
Excess Capacity (EC) = Functional Capacity (FC) - FR
EC = 1755 - 1124 = 631 Wyrs

China Lake FR = 390 Wyrs
EC = 608 - 390 = 218 Wyrs (assuming a 50/50 split between air-launched and sea-launched weapons)
FR = 390 + 388 = 778 Wyrs
EC = (608 + 607) - 778
EC = 1215 - 778
EC = 437 Wyrs (assuming 100 percent in air-launched weapons)

Assuming China Lake's division of R&D is 50/50 between air- and sea-launched weapons, Eglin AFB's excess capacity (631 Wyrs) can absorb China Lake's workload (390 Wyrs) but not the reverse as seen from the above China Lake data (China Lake's EC = 218 Wyrs and Eglin's requirement is FR = 1124 Wyrs). If China Lake is 100 percent air-launched weapons and 0 percent sea-launched weapons, Eglin AFB can still accept all of the air-launched R&D from China Lake with a modest shortfall of 147 Wyrs.

EC (Eglin) = 631 Wyrs
FR (CL) = 778 Wyrs @ 100 percent air-launched
Shortfall for Eglin = 631 - 778 Wyrs = 147 Wyrs

The reverse of this situation shows a large shortfall for China Lake (687 Wyrs) if China Lake tries to absorb all of the air-launched weapons R&D from Eglin.

EC (CL) = 437 Wyrs
FR (EG ) = 1124 Wyrs
Shortfall for CL = 437 - 1124 Wyrs = 687 Wyrs

The 147 Wyrs shortfall at Eglin AFB could be easily accommodated within the current base infrastructure.

- After Intra-Service Consolidations:

Because of the large number of Navy organizations currently involved in weapons R&D (ten organizations at this time), there is a significant opportunity for intraservice consolidation within the Navy before considering any interservice consolidation.

All Air Force (AF) consolidation at Eglin AFB -

FR (AF) = 1124 (Eglin) + 208 (WPAFB)
FR (AF) = 1332 Wyrs
EC (AF) = 631 (Eglin) - 208 (WPAFB)
EC (AF) = 631 - 208
EC (AF) = 423 Wyrs

All Navy consolidation at China Lake -

FR (Navy) = 516 + 890
FR (Navy) = 1406 Wyrs
FC (CL) = FR (CL) = 608 Wyrs

Therefore, China Lake can absorb 608 Wyrs of the Navy's requirement of 1406 Wyrs leaving 798 Wyrs
(1406 - 608 = 798 Wyrs) that has to be met by a second Navy site to meet the total Navy requirement.

A note worthy of mention is that Eglin already has full R&D capability (i.e., collocated acquisition) on site whereas the Navy at China Lake only has the technical capability to support acquisition (i.e., acquisition located at NAVAIR in Crystal City which was not included in the Navy's LJCSG Data).

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## Air Launched Weapons RDT&E
## Recap

- Eglin (vs China Lake) is Best Alternative for Consolidation of Fixed-Wing Air-Launched Weapons RDT&E
  - Based on Analysis of T&E and Lab JCSG Data
  - Full Capability and Capacity to Satisfy Requirements
  - Leverages Same RDT&E Resources to Support Collocated S&T, SPO, DT&E and Operational Test, Training and Tactics Development Users
  - Significant Joint and Cross-Servicing Activity Already in Place (e.g., AMRAAM, JDAM, LOCAAS, Hellfire Test Complex, Project Chicken Little, etc.)
- Energetics-Explosives RDT&E Treated as Integral Part of Weapons RDT&E
  - No Separate Analysis

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Based on the T&E JCSG data/results and analysis of LJCSG data, and using the LJCSG Chair's RDT&E integration concept, Eglin AFB (instead of China Lake) is the best alternative for consolidation of the DoD fixed-wing air-launched weapons RDT&E. Eglin AFB has the best capability in the DoD for consolidating the air-launched T&E and the capacity to absorb China Lake T&E workload, where the reverse is not true. Eglin AFB places both sea and land ranges at one site versus a land only capability for China Lake. Combined with WSMR, Eglin satisfies DoD T&E requirements for critical air, land, and sea space, diverse topography and diverse climatology, where the reverse combination would not be true with China Lake.

Eglin , combined with ASC (WPAFB), has the capacity (2080 Wyrs) to absorb all DoD workload (1848 Wyrs) for fixed-wing air-launched R&D whereas the reverse is not true (i.e., Navy capacity of 803 Wyrs vs 1332 Wyrs requirement for Air Force). Eglin alone has the excess capacity (631 Wyrs) to absorb China Lake's air-launched R&D workload (390 Wyrs). This would leave the Navy and Army capabilities for sea- and land-launched R&D in place and would collocate the air-launced weapons acquisition with the technical capabilities, versus the Navy approach where the acquisition function is located separately at NAVAIR in Crystal City, VA. This alternative allows the research, development, acquisition, T&E and Operational Training and Tactics Development/Evaluation communities to leverage the same RDT&E resources. The precedent for this alternative is readily illustrated by the significant joint and cross-servicing activities already in place at Eglin AFB, e.g., AMRAAM, JDAM, LOCAAS, Hellfire Test Complex, Project Chicken Little, etc.

As noted earlier, Energetics-Explosives RDT&E is an embedded part of Weapons RDT&E and thus covered in the above analysis.

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## Air Launched Weapons RDT&E
## Recap (Cont'd)

- Similar to T&E Analysis, Significant Opportunities Exist for Navy and Army for Intra-Service R&D Consolidation
  - Army Could Consolidate from 4 to 2 Activities
  - Navy Could Consolidate from 10 to 2 Activities
  - Air Force is Already Consolidated at 2 Locations (Could go to 1)

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Similar to the result found for T&E, both the Army and the Navy have significant opportunities for intra-Service R&D consolidation. The Air Force is already streamlined and consolidated at 2 locations but could consolidate to one location if required. The data show that the Army could consolidate from 4 to 2 activities, while the Navy could consolidate from 10 to 2 activities.



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## Energetics-Propulsion S&T Capabilities

| Site | Solids | | Liquids | | | |
|---|---|---|---|---|---|---|
| | Research Labs | Propellant Mix Capabilities | Mono & Bi-Propellants | Cryogenic Propellants | Electrics/ Solar | High-Energy Density Materials |
| PL | Yes | Yes | Yes | Yes | Yes | Yes |
| CL | Yes | Yes | No | No | No | No |
| RTTC | Yes | UNK | No | No | No | No |

PL = Phillips Lab (AF)
CL = China Lake (Navy)
RTTC = Redstone Technical Test Center (Army)

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LJCSG Chair's RDT&E alternatives, as forwarded under Memo #4 (Reference 3), indicated excess capacity in this function and proposed consolidating all missile and rocket propulsion RDT&E at NAWC/CL. Principal candidates for closure or realignment were Philips Laboratory, Edwards AFB CA, and MRDEC, Redstone Arsenal AL.

The analyses provided by the LJCSG Chair to support these conclusions were very limited. The analyses did not contain any computation of functional capacities, functional requirements, excess capacity, etc., nor were there analyses to indicate that any optimization model runs had been accomplished to determine the best workload assignments based on functional values.

Because of this analysis void, the Air Force constructed its own analysis by using both certified data from the Supplemental Data Call on Energetics and drawing on functional expert judgment. From this review, the table above was constructed to show the wide spectrum of S&T capabilities across Philips Laboratory (PL), China Lake (CL), and Redstone Test Center (RTTC). The table shows the diversity of technology areas within solid and liquid propulsion and shows involvement by the research and development laboratories.

It is clear from this comparison that only the Air Force's PL has the full spectrum S&T capability, with CL and RTTC having predominately solids capability.

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# ENERGETICS - PROPULSION T&E CAPABILITIES

| Site | Replacement Value ($M) | Ambient Facilities | | | | Altitude | Altitude Facilities | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Liquids | | Solids | | | Liquids | | Solids | |
| | | No. | Thrust (lbf) | No. | Thrust (lbf) | | No. | Thrust (lbf) | No. | Thrust (lbf) |
| PL | $188.80 | 7 | 10,000 K | 13 | 6,000 K | 100 K ft | 1 | 50 K | 2 | 100 K |
| CL | $ 19.59 | 1 | 300 K | 8 | 1,500 K | - | 0 | - | 0 | - |
| RTTC | $ 4.05 | 1 | 150 K | 6 | 2,000 K* | - | 0 | - | 0 | - |
| AEDC | $1,000.00 | 0 | - | 0 | - | 125 K ft | 2 | 1,500 K | 2 | 750 K |

* RTTC has a concrete pad for thrust of 10,000 K lbf, but not demonstrated and not instrumented

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Expanding the analysis to look at the T&E capabilities, as well as the S&T capabilities shown in the previous table, a quantitative comparison can be made for the facilities located at Philips Laboratory, China Lake, RTTC, and AEDC. AEDC was added because of its extensive T&E propulsion capabilities. Not only were solid and liquid capabilities addressed but also the ability of the activity to perform solid/liquid tests at both ambient and altitude conditions.

As can clearly be seen, the Air Force's Philips Laboratory has the dominant ambient facility capabilities, and AEDC the dominant altitude capabilities. China Lake and RTTC only have ambient capabilities that are subsets of Philips Laboratory.

In addition, Phillips Laboratory has a significantly larger infrastructure than China Lake or Redstone, as evidenced by their replacement values. These values were obtained from the LJCSG Supplemental Data Call. The value for AEDC was extracted from the T&E JCSG Data Call.



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## ENERGETICS - PROPULSION RECAP

- AIR FORCE PL IS BETTER ALTERNATIVE FOR CONSOLIDATING ENERGETICS-PROPULSION THAN CHINA LAKE
  - FULL CAPABILITY AND CAPACITY TO SATISFY REQUIREMENTS
  - SIGNIFICANTLY HIGHER CAPITAL INVESTMENT THAN CHINA LAKE OR RTTC
- PL COMBINED WITH AEDC HAS CAPABILITY TO SATISFY TOTAL DOD REQUIREMENTS

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For energetics-propellants, the data presented in the previous two tables clearly show that from both an S&T and a T&E perspective, Philips Laboratory (PL) is clearly the activity of choice for consolidation, not China Lake. Philips Laboratory has full S&T capabilities (solid and liquid propulsion) with supporting research laboratories and personnel, whereas China Lake and RTTC have capability only in solid propulsion and no capability in liquid propulsion.

Additionally, from a T&E capability standpoint, Philips Laboratory has significant infrastructure already in place, $188.8M replacement value, for both ambient and altitude facilities. China Lake has only $19.59M worth of infrastructure in place while RTTC has only $4.05M, and both of these investments are only in the ambient facility area.

Combining Philips Laboratory's capabilities with AEDC's $1B capability for altitude testing can satisfy the total S&T and T&E DoD requirement for energetics-propellants.

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## Summary

- AF Core T&E Capabilities/Workload Consolidated to Maximum Extent Possible Based on Intra-AF Analysis
  - Eliminates All Excess Capacity Linked to I/S Savings
  - Leaves Capability/Capacity For Cross-Servicing
  - T&E JCSG Cross-Servicing Opportunities Being Worked
- Completion of T&E JCSG Analysis Plan Shows That AF T&E Activities Are Preferred Consolidation Sites
  - Subset of T&E JCSG Co-Chair Alternatives
  - Significant Cost/Savings and Reductions in Excess Capacity Achievable Beyond T&E JCSG Alternatives
  - Could Have TOA and End Strength Implications

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Although the Air Force has already consolidated its core T&E capabilities at AFFTC (Edwards) for Air Vehicle T&E, AFDTC (Eglin) for Armaments/Weapons T&E, and AEDC for major ground facilities (wind tunnels, and propulsion facilities) to support the above (as well as other Services and Agencies), it was recognized that there were additional opportunities to realign/consolidate facilities from specialty sites based on the projected workload. Consequently, it went beyond just the integration of the T&E JCSG alternatives for "non-core" T&E Activities into its BRAC '95 recommendations and included these additional opportunities.

The Air Force has recommended consolidating its remaining T&E facilities to the maximum extent possible (i.e., not geographically constrained and cost-effective to move) in its BRAC '95 recommendations. The AF also offered to cross-service the other MilDeps wherever there was a match with AF core T&E capabilities, available capacity and appeared to be beneficial to AF and DoD. This resulted in the minimum T&E infrastructure and minimum achievable excess capacity (i.e., no further savings through facility consolidations) to support AF core T&E requirements.

By completing the T&E JCSG analysis plan, using certified data, the AF was able to show that further reductions in excess capacity among "core" T&E Activities are possible by identifying technically and economically viable alternatives. Those alternatives are supported by analysis of certified data and are subsets of the T&E JCSG Co-Chair alternatives, which were not supported by analysis. In all cases, AF T&E activities are the best consolidation sites, based on analysis of certified data. This is not surprising given that the AF T&E activities scored the highest Functional Values in all three functional areas (Air Vehicle, Armament/Weapons, and Electronic Combat)

In those cases involving the realignment of a significant number of personnel and/or equipment, some adjustments in the gaining site's Total Obligation Authority (TOA) and end-strength may be required for Base Operating Support, Real Property Maintenance, I&M, and O&M.

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## Summary (Cont'd)

- Combined Lab/T&E Analysis of LJCSG Chair Alternative to Consolidate RDT&E of Conventional Weapons Shows Eglin Better Consolidation Site (versus China Lake)
  - Energetics-Explosives an Integral Part
- Similar Analysis for Energetics-Propulsion Shows PL(Edwards) Better Consolidation Site (versus China Lake)
  - Combined with AEDC, Provides Capability to Satisfy DoD Requirements
- Significant Opportunities for Intra-Navy and Intra-Army Consolidations
  - Intra-Service Consolidations Should Be a Prerequisite Before Inter-Servicing Considered

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Combining the T&E JCSG data and results with analysis of the LJCSG certified data clearly shows Eglin AFB, FL to be the best site (versus China Lake) within DoD for consolidation of fixed-wing, air-launched weapons RDT&E. This includes all associated work in energetics-explosives which is an integral part of conventional weapons RDT&E.

A similar analysis for energetics-propellants shows Philips Laboratory, Edwards AFB CA, to be the best consolidation site (versus China Lake) and when Philips Laboratory is combined with AEDC, these two activities can provide the total capability to satisfy the DoD S&T and T&E requirements.

It is clear from the data that the Navy and the Army have significant opportunities for intra-service consolidations. These intra-Navy and intra-Army consolidations should be a prerequisite before any inter-Service consolidations are considered.

7

## Appendix A

## REFERENCES

1. DepSecDef Memorandum of January 7, 1994, 1995 Base Realignments and Closures (BRAC 95)

2. T&E JCSG Co-Chairmen Memorandum of November 22, 1994, Alternatives for Test and Evaluation in Base Realignment and Closure 1995 (BRAC 95) Deliberations

3. DDR&E Memorandum of November 29, 1994, Additional BRAC 95 Laboratory Alternatives for Military Department Consideration (#4)

4. T&E JCSG Analysis Plan, dated 3 August 1994 and amended 3 October 1994

5. SAF/MII Memorandum of December 14, 1994, Assessments of JCSG T&E Alternatives

6. T&E JCSG Co-Chairmen Memorandum of December 20, 1994, Assessments of JCSG-TE Alternatives

7. SAF/MII Memorandum of December 22, 1994, Assessment of JCSG-TE Alternatives

8. AF/TE Memorandum of 10 January 1995, Assessments of T&E JCSG Alternatives

9. SAF/MII Memorandum of February 8, 1995, Final Assessment of T&E Alternatives

10. ASD(ES) Memorandum, of November 23, 1994, 1995 Base Realignments and Closures (BRAC 95) -- Policy Memorandum Two -- Joint Cross-Service Group Functional Analysis Process, with attachment, Joint Cross-Service Analysis Tool User's Guide

11. T&E JCSG Co-Chairmen Memorandum of August 4, 1994, 1995 Base Realignment and Closure (BRAC) Test and Evaluation (T&E) Joint Cross-Service Group Supplemental Data Call

12. ASD(ES) Memorandum of December 27, 1994, 1995 Base Realignments and Closures (BRAC 95) - Clarification of the Joint Cross-Service Group Functional Analysis Process

# TEST AND EVALUATION (T&E) JOINT CROSS-SERVICE GROUP

# ANALYSIS PLAN

# FOR

# BASE REALIGNMENT AND CLOSURE (BRAC 95)

# CROSS SERVICE ANALYSES

Signed

John A. Burt
Co-Chair
T&E Joint Cross-Service Group

Signed

Co-Chair
T&E Joint Cross-Service Group



3 AUG 94

# T&E JOINT CROSS-SERVICE GROUP ANALYSIS PLAN

## 1.0 BACKGROUND

1.1 In a 7 Jan 94 memorandum entitled "1995 Base Realignment and Closures (BRAC 95)", the DEPSECDEF established Joint Cross Service Groups (JCSGs) in six areas with significant potential for cross-service impacts in BRAC 95. Each JCSG was tasked to accomplish the following:

- To determine the common support functions and bases

- To establish the guidelines, standards, assumptions, measures of merit, data elements, and milestone schedules for DoD Component conduct of cross-service analysis of these common support functions

- To oversee DoD Component analyses of the common support functions

- To review excess capacity analyses

- To develop closure and realignment alternatives and numerical excess capacity reduction targets for consideration in such analysis

- To analyze cross-service tradeoffs

1.2 The purpose of this plan is to outline how the analysis tasks will be accomplished and to describe the methodologies to be used in completing these tasks.

## 2.0 JOINT TEAM STRUCTURE

2.1 Attachment 1 summarizes the joint team structure and responsibilities for accomplishing the DEPSECDEF analysis tasks. Overall responsibilities of the Steering Group, Review Group, Military Departments, and Joint Cross Service Groups in the BRAC cross-servicing process are documented in the 7 Jan 94 DEPSECDEF Memorandum.

2.2 The Joint Working Group (JWG) is comprised of DoD Component members and reports directly to the T&E JCSG. It's principal role is to support the T&E JCSG in the development and conduct of the analysis, subject to the approval of the T&E JCSG. The T&E JCSG will also document all results and decisions for the record.

2.3 The Tri-Department BRAC Group is comprised of BRAC members from each Military Department who report directly to their Military Department. They are responsible for running the optimization and functional COBRA models for each JCSG. T&E inputs for the model will be provided by the T&E JCSG. Model outputs will be provided to the T&E JCSG for review and analysis by the JWG.

3.0 JOINT ANALYSIS PROCESS

3.1 Steps in the joint analysis process are summarized in Attachment 2.

3.2 The T&E JCSG will develop guidance for joint T&E data calls to support the joint analysis process. The Military Departments will conduct the data calls and provide the responses to the Joint Cross Service Group.

3.3 The T&E JCSG will use the methodologies presented in Appendices A-C to compute the T&E Functional Value (FV), Excess Capacity, and Projected Workload (PWL) based on information from the joint data call and the Future Years Defense Plan (FYDP). They will also develop optimization formulations and policy imperatives to support optimization model runs (see Appendix D). Questions, weight, and scoring process presented in Appendix E will be used to calculate functional values. All data will be documented IAW Appendix F, and analysis of classified data will be accomplished IAW Appendix G.

3.4 Notional data will be used to develop the optimization formulations. Unconstrained runs using real data will then be conducted using inputs from the T&E JCSG to develop alternatives satisfying workload requirements. Additional runs using site military values provided by the Military Departments will also be run to refine alternatives.

3.5 Collocation of T&E resources needed to support the test process in a T&E functional area (i.e., Air Vehicle, Armament/Weapons, or Electronic Combat) will be accomplished to the maximum extent possible in each alternative. Resources will be retained at other sites when geographically constrained, needed to satisfy workload, economically prohibitive to move, or for other operational reasons.

3.6 Sensitivity analysis will be conducted throughout the process to identify risk areas.

3.7 An operational feasibility assessment will be conducted by the T&E JCSG to ensure the capability to satisfy DoD T&E requirements is retained. Shortfalls in capability will be identified and necessary solutions developed to retain viable alternatives. A top-level concept of operations (CONOPS) will be generated for each alternative and will address MILCON, personnel movement and termination, equipment relocation, customer and stakeholder impacts, etc. The CONOPS will provide the basis for a Functional COBRA data call to determine if an alternative is cost effective using the COBRA Model. The functional COBRA will consist of COBRA runs using simplified input data sets and assumptions. These data sets and assumptions will be developed by the JWG and approved by the T&E JCSG. An approved version of COBRA will be used for these runs.

3.8 Alternatives that satisfy the DoD T&E workload and capability requirements and provide an acceptable return-on-investment from a T&E perspective will be recommended to the Military Departments for their consideration and integration into their closure/realignment candidates and alternatives from the other JCSGs.

4.0 SCHEDULE

4.1 Key milestones and schedules are shown in Attachment 2.

APPENDICES

A - T&E Functional Value Methodology
B - T&E Workload Projection Methodology
C - T&E Excess Capacity and Target Reduction Methodology
D - T&E Optimization Formulations
E - T&E Questions, Weights and Scoring Process
F - T&E Data Base Management Process
G - T&E Classified Data Analysis

ATTACHMENTS

(1) Joint Analysis Team Structure
(2) Joint Analysis Process

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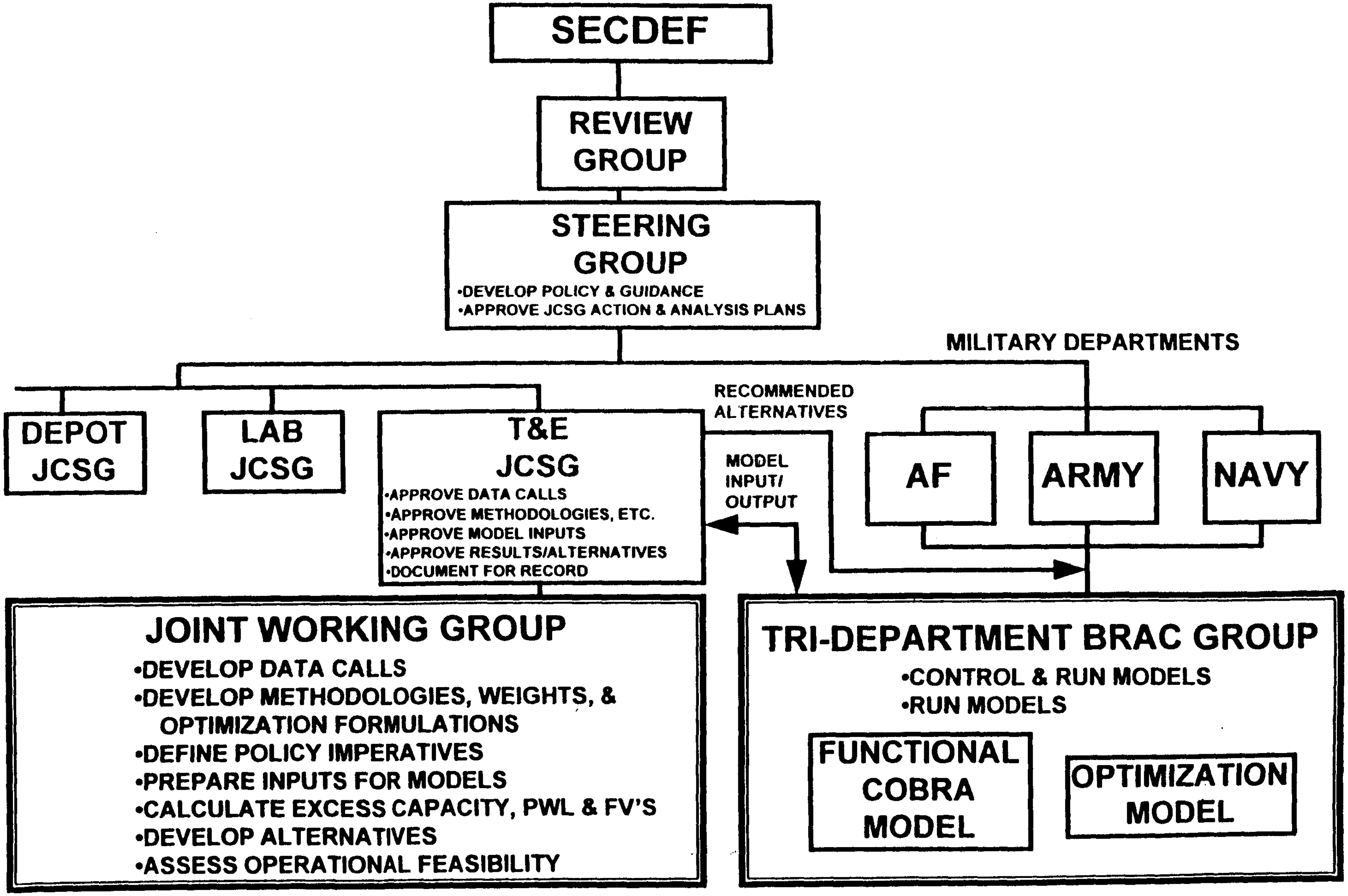
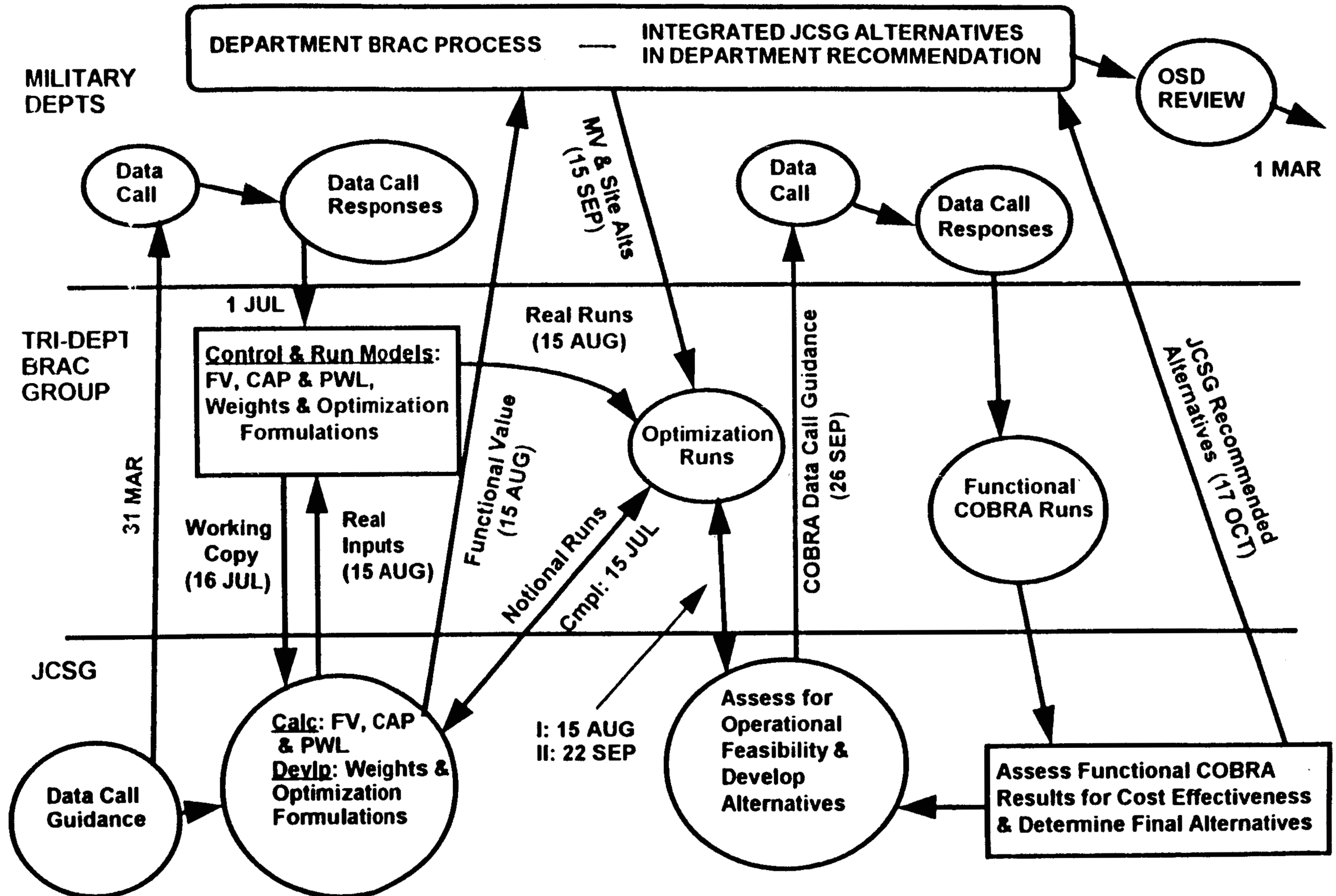
# JOINT ANALYSIS TEAM STRUCTURE




Attachment 1

# JOINT ANALYSIS PROCESS




Phases: I: UNCONSTRAINED
II: MV CONSTRAINED

Attachment 2

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# APPENDIX A. FUNCTIONAL VALUE

## METHODOLOGY AND FRAMEWORK

1. INTRODUCTION: An objective assessment of functional value for each site/activity which supports T&E of air vehicles, electronic combat, or armament/weapons is required as part of the Base Realignment and Closure (BRAC) cross-servicing process. This value will be used to support the development of alternatives for consolidating/realigning the T&E infrastructure.

2. DEFINITION: The standard dictionary definition of "value" is:

   a. Worth in usefulness or importance to the possessor; and

   b. A principle, standard or quality regarded as worthwhile or desirable.

Applying this standard definition, functional value for T&E joint cross-service analysis is defined as the value of performing T&E in one of the three functional areas (Air Vehicles, Electronic Combat, and Armament/Weapons) at a given site/activity.

3. PURPOSE:

This document describes the methodology the T&E JCSG will use to arrive at functional values based on certified data from the Military Departments.

This methodology and framework provides a quantitative, consistent, and defensible basis for generating functional values for each site/activity which performs Air Vehicles, Electronic Combat, and Armament/Weapons testing.

4. SCOPE:

The methodology generates functional values for each site/activity and each functional area using certified data submitted in response to the T&E JCSG data call. The three functional areas of T&E facilities/capabilities were selected for specific emphasis during cross-service analyses following analysis of the T&E Reliance study areas. These three areas -- Air Vehicle, Electronic Combat, and Armament/Weapons (excluding surface-to-surface) -- show the greatest potential for cross-service consolidation opportunities; others are predominantly or nearly Military Department unique.

5. FRAMEWORK:

The framework for calculating functional value is based on a top down approach which captures the principal attributes required to support T&E within each functional area. The framework (see Figure 1) is comparable to a work breakdown structure (WBS). At the top level, two broad functional values (Physical and Technical) are required:

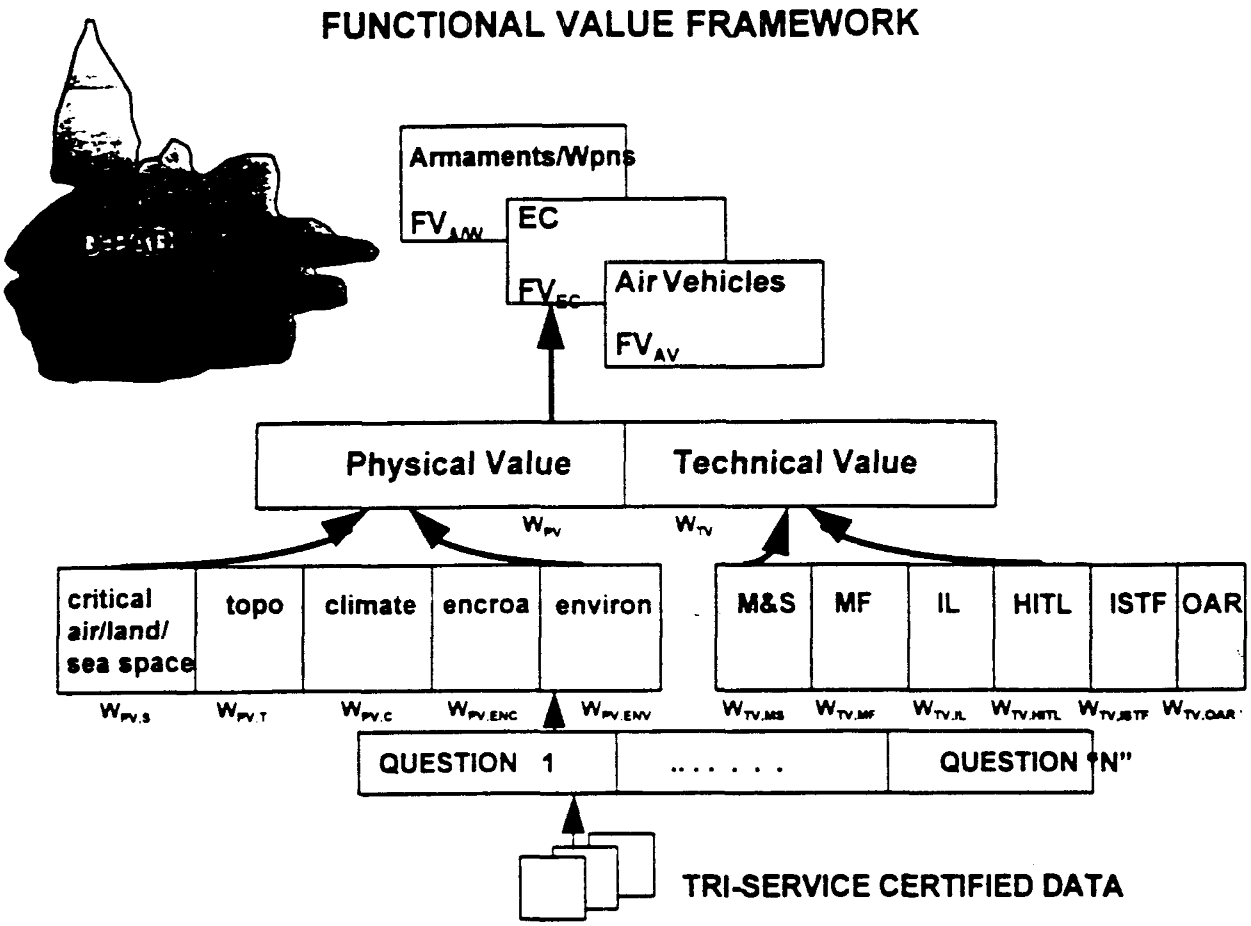



Figure 1

a. Physical Value. This category captures the intrinsic value of the air, land, and sea space as well as the varied topography and climates at a site as they relate to those required to support test and evaluation of system performance in real-world environments under realistic conditions. Encroachment and environmental categories attempt to capture to what extent future T&E operations might be affected by these factors.

b. Technical Value. This category captures the value of the man-made assets at each site in terms of their capability to support test and evaluation of current and future weapon systems.

These two top level categories (Physical and Technical) are further broken down into sub-categories. Physical value is based on a roll-up of critical air/land/sea space, topography, climate, encroachment, and environmental sub-categories. Technical value is based on a roll-up of six T&E test facility categories as defined in the T&E Data Call: (1) Digital Modeling and Simulation (DM&S), (2) Measurement Facilities (MF), (3) Integration Laboratories (IL),

(4) Hardware-In-The-Loop (HITL), (5) Installed Systems Test Facilities (ISTF), and (6) Open Air Ranges (OAR).

Each of the sub-categories will be scored based on a set of questions unique to the functional area (air vehicles, electronic combat, and armament/weapons).

Included in the functional value framework is a set of weighting factors assigned in a top down process to the top two levels. The relative importance of each capability determines its weight. The weights will be the same for all three functional areas. At lower levels, questions and scoring scales may be different within each functional area.

All questions, weights, and scoring scales as approved by the T&E JCSG are contained in Appendix E.

6. SCORING PROCESS:

The T&E functional value scoring process is shown in Figure 2. Each site's/activity's data call responses will be evaluated against functional area scoring criteria and scored by the T&E JWG. Relevant data for a facility which conducts testing in more than one functional area will be scored in each area. Decision Pad (D-PAD) software will be used to facilitate scoring site responses and rolling up scores into functional values for each site/activity.

## T&E JCSG FUNCTIONAL VALUE SCORING PROCESS

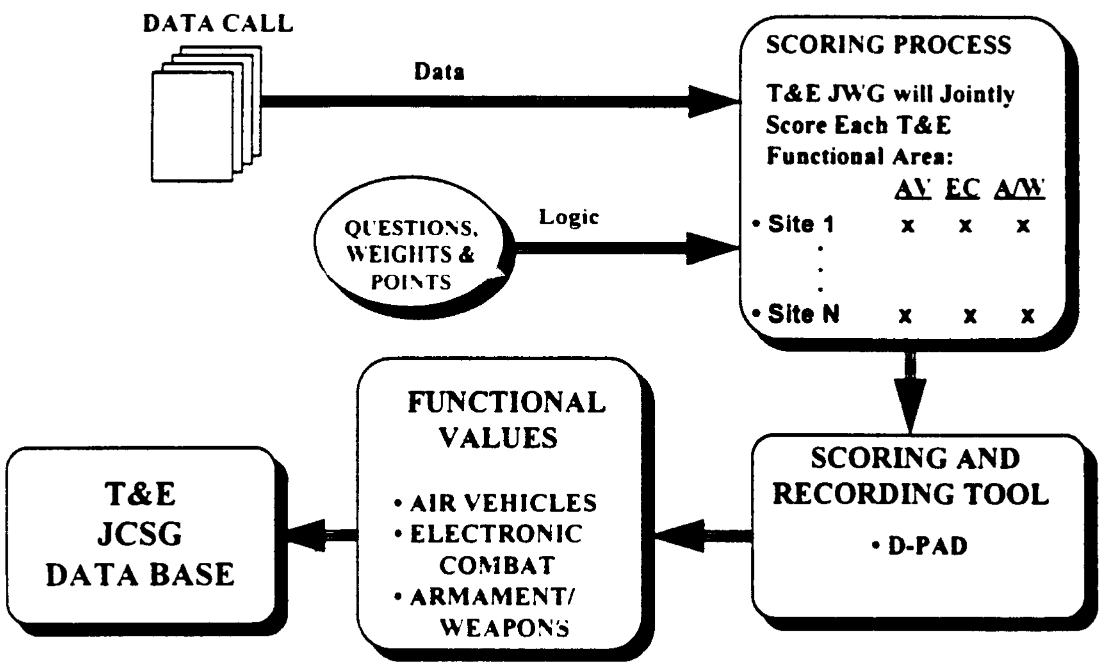



Figure 2

7. WEIGHTING NORMALIZED SCORES:

The mathematical formula for summing functional value scores is shown below. In addition, the framework consistently measures each site/activity against the same set of questions, and the method is reproducible. All resulting functional values are between 0 and 100.

## FUNCTIONAL VALUE WEIGHTING/SCORING

1. NORMALIZE ALL SCORES
2. EACH SCORE HAS AN ASSOCIATED WEIGHT
3. WEIGHTS ARE DECIMAL FRACTIONS LESS THAN ONE

$$\mathrm{FV} \equiv \sum_{i=1}^{2}\left[\mathrm{W}_i\left(\sum_{j=1}^{m_i}\mathrm{W}_{i,j}\left[100\left(\frac{\sum_{k=1}^{n_{i,j}} X_{i,j,k}}{\sum_{k=1}^{n_{i,j}} P_{i,j,k}}\right)\right]\right)\right]$$

$\sum_i \mathrm{W}_i = 1.0$

$\sum_j \mathrm{W}_{i,j} = 1.0$

$\mathrm{W}_i$ = WEIGHT ASSOCIATED WITH CAPABILITY
$i$ = PV and TV
$\mathrm{W}_{i,j}$ = WEIGHT ASSOCIATED WITH CAPABILITY CATEGORY
$j$ = 1 THROUGH NUMBER OF CATEGORIES
$X_{i,j,k}$ = SITE/ACTIVITY'S SCORE AGAINST QUESTION $x$
$P_{i,j,k}$ = MAXIMUM SCORE FOR QUESTION $x$
$k$ = 1 THROUGH NUMBER OF QUESTIONS
FV = FUNCTIONAL VALUE FOR A PARTICULAR FUNCTIONAL AREA SUCH AS AIR VEHICLE, ELECTRONIC COMBAT, OR ARMAMENT/WEAPONS

8. SUMMARY:

In summary, the functional value methodology and framework provides complete visibility into the relative importance, or weight, of each capability. Weights establish which capabilities are most critical to DoD. The site's/activity's functional values represent its inherent worth to DoD in three key functional areas: air vehicles, electronic combat, and armament/weapons.

# APPENDIX B. T&E WORKLOAD PROJECTION METHODOLOGY

**1. INTRODUCTION:** Inherent to the determination of excess capacity is the development of a future T&E workload projection for each of the functional areas being examined by the T&E Joint Cross-Service Group (JCSG). This document describes the method selected for projecting future workload requirements for the T&E joint cross-service analyses. The underlying premise for this method is that future T&E workload will increase/decrease in direct proportion to funding increases/decreases in the DoD budget. This method was selected based on its ability to provide a quantitative, consistent, and defensible basis for estimating future T&E workload.

**2. ASSUMPTIONS:**

a. The amount of workload generated by a fixed dollar amount is constant over the period FY92 - FY01.

b. The percentage of total workload for a given functional area that must be accomplished by each of the six test facility categories remains constant over the period FY92 - FY01.

c. The T&E JCSG analysis will include minimization of excess capacity as one of its goals; therefore, workload projections must be done at the test facility category level.

d. Outlay rates used in support of the FY95 President's Budget can be used for FY93 - 99.

e. Workload for FY00 and FY01 equals that for FY99.

**3. SCOPE:** The methodology projects T&E workload throughout the FY95 - FY01 period and utilizes the workload measures specified in the JCSG T&E data call. The methodology draws upon historical workload information contained within the data call and funding data contained in the FY95 - 99 FYDP. Generation of T&E workload projections is the responsibility of the T&E JCSG.

**4. METHODOLOGY:** The method to be used in the T&E joint cross-service analysis generates a single T&E workload projection index for all functional areas for each fiscal year between FY95 - FY01. The basic steps in this method are as follows:

a. From the FYDP compute the total Budget Authority (BA) for Operation and Maintenance (O&M); Research, Development, Test and Evaluation (RDT&E); and Procurement funding.

b. Convert into constant FY95 dollars by deflating/inflating totals with certified inflation indices provided by the DoD Comptroller.

where $TOM_x$ = total O&M BA for fiscal year x expressed in constant FY95 dollars.

$TR_x$ = total RDT&E BA for fiscal year x expressed in constant FY95 dollars.

$TP_x$ = total Procurement BA for fiscal year x expressed in constant FY95 dollars.

TOTAL BUDGET AUTHORITY

| | FY90 | FY91 | FY92 | FY93 | ............ | ............ | FY00 | FY01 |
|---|---|---|---|---|---|---|---|---|
| O&M | $TOM_{90}$ | $TOM_{91}$ | $TOM_{92}$ | $TOM_{93}$ | ............ | ............ | $TOM_{00}$ | $TOM_{01}$ |
| RDT&E | $TR_{90}$ | $TR_{91}$ | $TR_{92}$ | $TR_{93}$ | ............ | ............ | $TR_{00}$ | $TR_{01}$ |
| Procurement | $TP_{90}$ | $TP_{91}$ | $TP_{92}$ | $TP_{93}$ | ............ | ............ | $TP_{00}$ | $TP_{01}$ |

c. Compute total outlays for fiscal year x using certified outlay rates provided by the DoD Comptroller.

$$TBA_x = \sum_{k=1} (TOM_{x+1-k} \times OMOR_k + TR_{x+1-k} \times ROR_k + TP_{x+1-k} \times POR_k)$$

where $OMOR_k$ = outlay rate for O&M funding for kth year of the appropriation.

$ROR_k$ = outlay rate for RDT&E funding for kth year of the appropriation.

$POR_k$ = outlay rate for Procurement funding for kth year of the appropriation.

d. Compute average outlay baseline (AOB) for FY92 and FY93.

$$AOB = \frac{TBA_{92} + TBA_{93}}{2}$$

e. Divide total outlay baseline for fiscal year x from step c by the average outlay baseline from step d for fiscal years FY95 - FY01 to get the workload projection index for all functional areas.

$$I_x = \frac{TBA_x}{AOB} \qquad x = FY95, FY96, \ldots\ldots\ldots, FY01$$

f. Select test facility category ($TFC_j$; $j = 1, 2, \ldots\ldots, 6$) and functional area ($FA_i$ ; $i = 1, 2, 3$).

g. Compute total workload baseline for each test facility category for FY92 and FY93 within this functional area by summing over all sites s using test hour data from the Historical Workload form in the T&E JCSG Data Calls.

$$WTB_{ij} = \sum_{s} \frac{FY92_i \text{ Workload } TFC_j + FY93_i \text{ Workload } TFC_j}{2}$$

h. Multiply total workload baseline from step g by the workload projection index from step e to get the projected workload $W_{xij}$ for test facility category j for fiscal year x and functional area i.

$$W_{xij} = FY_{xi} \text{ Workload } TFC_j = I_x \times WTB_{ij}$$

i. Repeat steps f through h for each test facility category and each functional area.

# TOTAL PROJECTED T&E WORKLOAD

| Functional Area | Test Facility Category | FY95 | FY96 | ................. | ................. | FY01 |
|---|---|---|---|---|---|---|
| Air Vehicles | DMS | $W_{9511}$ | $W_{9611}$ | ................. | ................. | $W_{0111}$ |
| | MF | $W_{9512}$ | $W_{9612}$ | ................. | ................. | $W_{0112}$ |
| | IL | $W_{9513}$ | $W_{9613}$ | ................. | ................. | $W_{0113}$ |
| | HITL | $W_{9514}$ | $W_{9614}$ | ................. | ................. | $W_{0114}$ |
| | ISTF | $W_{9515}$ | $W_{9615}$ | ................. | ................. | $W_{0115}$ |
| | OAR | $W_{9516}$ | $W_{9616}$ | ................. | ................. | $W_{0116}$ |
| EC | DMS | $W_{9521}$ | $W_{9621}$ | ................. | ................. | $W_{0121}$ |
| | MF | $W_{9522}$ | $W_{9622}$ | ................. | ................. | $W_{0122}$ |
| | IL | $W_{9523}$ | $W_{9623}$ | ................. | ................. | $W_{0123}$ |
| | HITL | $W_{9524}$ | $W_{9624}$ | ................. | ................. | $W_{0124}$ |
| | ISTF | $W_{9525}$ | $W_{9625}$ | ................. | ................. | $W_{0125}$ |
| | OAR | $W_{9526}$ | $W_{9626}$ | ................. | ................. | $W_{0126}$ |
| Armament/Weapons | DMS | $W_{9531}$ | $W_{9631}$ | ................. | ................. | $W_{0131}$ |
| | MF | $W_{9532}$ | $W_{9632}$ | ................. | ................. | $W_{0132}$ |
| | IL | $W_{9533}$ | $W_{9633}$ | ................. | ................. | $W_{0133}$ |
| | HITL | $W_{9534}$ | $W_{9634}$ | ................. | ................. | $W_{0134}$ |
| | ISTF | $W_{9535}$ | $W_{9635}$ | ................. | ................. | $W_{0135}$ |
| | OAR | $W_{9536}$ | $W_{9636}$ | ................. | ................. | $W_{0136}$ |

## Appendix C: T&E Excess Capacity and Target Reduction Methodology

**1. Introduction:** Excess capacity is the arithmetic difference between Capacity and Projected Workload. Appendix B outlines the method for determining Projected Workload. This document describes the method selected for establishing T&E facility category Capacity within the three functional areas identified for cross-service analysis. Capacity will be calculated on an estimated single shift standard.

**2. Assumptions:**

a. A standard single shift workyear is 2008 test facility hours (365 days, less 10 holidays, less 104 weekend days, times 8 hours per day).

b. Amount of work that can be accomplished per facility hour remains constant over the period of FY93 through FY01.

**3. Scope:** The methodology estimates the capacity of a T&E facility/capability by using the test hours per facility hour of that facility/capability and extrapolating it over an annual single shift operation. This value is then allocated by T&E Functional Area and percent T&E usage as indicated on the General Information Worksheet supporting that facility/capability. A double shift operation will be examined as an extension to the primary analysis based on the single shift standard.

**4. Methodology:**

a. CAPACITY: The method to be used in the T&E JCSG calculations generates a single estimated T&E capacity for each T&E Test Facility Category within each T&E Functional Area. The basic steps in this method are as follows:

(1) Total Facility/Capability Capacity (TFCC): Compute the TFCC (in units of test hours) by taking the total of the "Test At One Time" from Column 5 on the Determination of Unconstrained Capacity worksheet, and multiplying it by 2008.

(2) Total T&E Capacity (TEC): Compute the TEC by multiplying TFCC by the percent of T&E usage of the facility/capability as indicated in the General Information worksheet.

(3) Total T&E Capacity Allocated by Functional Area: Compute the total T&E capacity of the facility/capability to be allocated to each functional area (AVCAP for Air Vehicles, WEPCAP for Armament/Weapons & ECCAP for Electronic Combat) by multiplying the TEC by the percentage indicated for each functional area in the General Information worksheet.

(4) Add the above functional area capacities to the respective T&E Test Facility Category totals, within each functional area.

b. EXCESS CAPACITY: The method to be used in the T&E JCSG calculations generates a single T&E excess capacity for each T&E Test Facility Category within each T&E Functional Area. The basic step in this method is to subtract the projected workload for the appropriate T&E Test Facility Category within a T&E Functional Area from the total T&E capacity allocated to that same T&E Test Facility Category within the same T&E Functional Area.

c. TARGET REDUCTION: Targets for reducing excess capacity will be determined based on the methodology outlined in Attachment 1 to this Appendix. Special attention will be given to facilities/capabilities that show a negative excess capacity as a result of the nature of their operations.

**5. Execution:** The above algorithm will be incorporated into an MS Excel spreadsheet that will automatically calculate and prorate the capacities using the following inputs:

a. TOTSUM: Number of Tests At One Time (per facility hour). Taken from column 5 of the Determination of Unconstrained Capacity worksheet.

b. %T&E: Percentage of T&E usage of the facility/capability. Taken from the "PERCENTAGE USE:" row of the General Information worksheet.

# EXCESS CAPACITY REDUCTION TARGET METHODOLOGY

➢ **Target**

- Minimize all excess capacity as defined below, where cost effective

➢ **Excess Capacity Definition**

- Delta between single-shift capacity and projected workload for FY01

➢ **Reduction Target Constraints**

- Separate for each T&E functional area
- Separate for each test facility category within each T&E functional area
- Exclude excess capacity associated with unique, one-of-a-kind facilities or other capabilities that must be retained IAW the policy imperatives

➢ **Cost Effectiveness**

- Based on total costs, to include non-T&E and customer costs

**Attachment 1**

c. %AV: Percentage of T&E usage for Air Vehicle T&E. Taken from the "T&E" column of the "BREAKOUT BY T&E FUNCTIONAL AREA (%):" section of the General Information worksheet.

d. %WEP: Percentage of T&E usage for Armament/Weapons T&E. Taken from the "T&E" column of the "BREAKOUT BY T&E FUNCTIONAL AREA (%):" section of the General Information worksheet.

e. %EC: Percentage of T&E usage for Electronic Combat T&E. Taken from the "T&E" column of the "BREAKOUT BY T&E FUNCTIONAL AREA (%):" section of the General Information worksheet.

f. PWL: Projected workload for FY01 for each intersection of T&E Test Facility Categories and T&E Functional Areas (a total of 18 inputs).

# APPENDIX D. T&E OPTIMIZATION FORMULATIONS

**1. INTRODUCTION:** To assist in the generation of cross-service functional alternatives for consideration by the Military Departments, a common analytical tool based on mixed integer, linear programming has been adopted by the Joint Cross-Service Groups (JCSGs). This document describes the specific adaptation of this common tool to support the T&E joint cross-service analysis process.

**2. ASSUMPTIONS:**

a. Policy imperatives agreed to by the T&E JCSG can be incorporated into the optimization formulations in the form of additional constraints.

b. The following data will be available for all of the sites and T&E functional areas:

| Data Elements | Description |
|---|---|
| $mv_s$ | Military value of site *s* expressed as 3 (high), 2 (medium), or 1 (low). |
| $fv_{sf}$ | Functional value for performing function *f* at site *s* expressed as a number from 0 (low) to 100 (high). |
| $cap_{sfr}$ | Capacity of site *s* to perform function *f* using test facility category *r* |
| $req_{fr}$ | Total DoD requirement to perform function *f* using test facility category *r* |

The military value of a site, $mv_s$ , measures the overall value of the site to the department and will be provided by the Military Departments. The methods to be employed by the T&E JCSG to determine the functional value, capacity and workload requirements are described in other appendices.

**3. SCOPE:** Different optimization formulations (as described in the following section) have been selected to support the identification of cross-service alternatives and to provide a full understanding of the effect of individual parameters (*e.g.*, functional value, capacity, workload, *etc*) on the benefits/risks associated with each alternative.

Optimization model runs will be performed by the Tri-Department BRAC Group using inputs as approved by the T&E JCSG. During the course of the analysis, modifications, revisions, and additions to the optimization formulations and policy imperatives may be required to support the identification and refinement of viable cross-service alternatives. All modifications, revisions, and additions will be approved by the T&E JCSG prior to implementation.

**4. OPTIMIZATION FORMULATIONS:** The four optimization formulations described below vary only in the specification of the objective function. Some of the objective functions involve summing terms across different types of test facilities and functional areas, where the terms including factors for the workload assigned or workload capacity are measured in different units. These workload factors are always normalized in the objective functions by dividing by the corresponding workload requirements, so that the objective functions will only sum terms with consistent relative workload units. All four of the optimization formulations support a parametric variation in the relative weights ($w$ and $1-w$) applied to a pair of terms in each objective function. This allows the T&E JCSG to develop alternatives which evaluate the impact of composite objective functions; for example, minimizing the number of open sites as a primary objective while maximizing the functional value of the workload assignment as a subordinate objective. The weight $w$ is constrained between the values of 0 and 1 to avoid any distortion of the scale or units for the components of the objective functions. Each optimization formulation will be multiplied by a constant if necessary for numerical stability of the computational runs.

**Objective Functions.**

a. The **MAXSFV** formulation. This formulation maximizes the sum of the functional values for all of the retained sites. The objective function for this formulation is given in Table 1. If the number of sites to be retained is not included as a constraint, all of the sites will be retained in the solution because the objective function is maximized when $o_s = 1$ for all sites. Obtaining meaningful results with this formulation, therefore, requires a constraint on the number of sites retained. If $w = 1$, then this formulation reduces to maximizing the functional value sum over the open sites. If $w = 0$, then the objective function maximizes functional value weighted by the fraction of required workload assigned to the site.

b. The **MINNMV** formulation. This formulation will find a small number of sites having the highest military value that can accommodate the DoD required workload. In addition, it will assign the DoD requirement for each cross-service function to the retained sites (or activities) having the highest functional value for that function. The purpose of this formulation is to assign, to the extent possible, the cross-service functional requirements to sites or activities having high military value and high functional values.

The objective function for this formulation is given in Table 2. This formulation is referred to as **MINNMV** because it minimizes the sum of 4 - $nmv_s$ for retained sites or activities. Sites or activities having a high military value (3) will have 1 as their value for ***nmv***, while sites with low military values (1) will have 3 as their value for ***nmv***.

If $w = 1$, then the objective function includes only military value as a term. If $w = 0$, then the objective function is identical to **MAXSFV** with its $w = 0$.

c. The **MINXCAP** formulation. If the parameter $w$ is set to a large value (*e.g.*, $w = 0.9$), this problem formulation will find the set of retained sites having the smallest total functional capacity but still able to perform the DoD functional requirement. Depending on $w$, functional assignments are also optimized. The objective function for this formulation is given in Table 3.

If $w = 0$, this formulation - like the **MINMNV** formulation - is also equivalent to the **MAXSFV** formulation with its $w = 0$. If $w$ is set to a large value, excess capacity is reduced as much as possible with minimal regard for functional value.

d. The **MINSITES** formulation. This formulation, depending on the value of $w$, will find the minimum-sized set of sites that can perform the DoD functional requirement. The objective function for this formulation is given in Table 4.

If $w$ is set to a large value (*e.g.*, 0.9), the cross-service functional workload is assigned to the smallest number of sites, with minimal regard for functional values.

**Constraints.** The constraint equations common to all four optimization formulations are given in Table 5. The constraint on the number of sites will be deactivated for some optimization runs - in particular, for the **MINSITES** formulation which seeks the minimum number of sites to be retained as part of the solution.

Individual optimization runs will be made for each functional area to support development of alternatives.

**Policy Imperatives**. The initial set of policy imperatives and associated rationale are provided in the attached Annex.

**Annex.** Initial Policy Imperatives and Rationale

TABLE 1.

MAXSFV OPTIMIZATION FORMULATION

$$\underset{\text{with respect to } O_s,\, l_{fr}}{\text{Maximize}} \left\{ \frac{w}{u_1} \cdot \sum_s o_s \cdot \sum_f \mathrm{fv}_{sf} + \frac{(1-w)}{u_2} \cdot \sum_f \sum_r \frac{\sum_s l_{fr} \cdot \mathrm{fv}_{sf}}{\mathrm{req}_{fr}} \right\},$$

where $s$ is the site index,
$f$ is the functional area index, and
$r$ is the test facility category index,

$w$ and $1 - w$ are weights assigned for each optimization run ($0 \leq w \leq 1$),

$u_1$ is calculated from $\sum_s \sum_f \mathrm{fv}_{sf}$,

$u_2$ is calculated from $\sum_f \sum_r \mathrm{fv}_{max}$,

$o_s$ is the open-site decision variable for each site $s$,

$\mathrm{fv}_{sf}$ is the functional value for site $s$ and functional area $f$,

$l_{fr}$ is the workload assigned to site $s$ for functional area $f$ and test facility category $r$,

$\mathrm{req}_{fr}$ is the workload requirement for functional area $f$ and test facility category $r$

TABLE 2.

---

MINNMV OPTIMIZATION FORMULATION

$$\underset{\substack{\text{with respect to}\\ o_s,\, l_{fr}}}{\text{Minimize}} \left\{ \frac{w}{u_1} \cdot \sum_s o_s \cdot nmv_s - \frac{(1-w)}{u_2} \cdot \sum_f \sum_r \frac{\sum_s l_{fr} \cdot fv_{sf}}{req_{fr}} \right\},$$

where $s$ is the site index,
$f$ is the functional area index,
$r$ is the test facility category index,

$w$ and $1-w$ are weights assigned for each optimization run ($0 \le w \le 1$),

$u_1$ is calculated from $\sum_s nmv_s$,

$u_2$ is calculated from $\sum_f \sum_r fv_{max}$,

$o_s$ is the open-site decision variable for each site $s$,

$nmv_s$ is equal to ($4 - mv$) for site $s$ and $mv$ is its military value (assigned as 1, 2, or 3).

$fv_{sf}$ is the functional value for site $s$ and functional area $f$,

$l_{fr}$ is the workload assigned to site $s$ for functional area $f$ and test facility category $r$,

$req_{fr}$ is the workload requirement for functional area $f$ and test facility category $r$

TABLE 3.

MINXCAP OPTIMIZATION FORMULATION

$$\underset{\substack{\text{with respect to} \\ O_s\ \forall fr}}{\text{Minimize}} \left\{ \frac{w}{u_1} \cdot \sum_f \sum_r \frac{\sum_s o_s \cdot cap_{sfr}}{req_{fr}} - \frac{(1-w)}{u_2} \cdot \sum_f \sum_r \frac{\sum_s L_{fr} \cdot fv_{sf}}{req_{fr}} \right\}$$

where $s$ is the site index,

$f$ is the functional area index,

$r$ is the test facility category index,

$w$ and $1-w$ are weights assigned for each optimization run ($0 \le w \le 1$),

$u_1$ is calculated from $\sum_f \sum_r \frac{\sum_s cap_{sfr}}{req_{fr}}$,

$u_2$ is calculated from $\sum_f \sum_r \frac{\sum_s fv_{max}}{req_{fr}}$

$o_s$ is the open-site decision variable for each site $s$,

$fv_{sf}$ is the functional value for site $s$ and functional area $f$,

$L_{fr}$ is the workload assigned to site $s$ for functional area $f$ and test facility category $r$,

$cap_{sfr}$ is the capacity of site $s$ for functional area $f$ and test facility category $r$

TABLE 4.

---

MINSITES OPTIMIZATION FORMULATION

$$\underset{\substack{\text{with respect to} \\ o_s, l_{sfr}}}{\text{Minimize}} \left\{ \frac{w}{u_1} \cdot \sum_s o_s - \frac{(1-w)}{u_2} \cdot \sum_f \sum_r \frac{\sum_s l_{sfr} \cdot fv_{sf}}{req_{fr}} \right\},$$

where $s$ is the site index,

$f$ is the functional area index,

$r$ is the test facility category index,

$w$ and $1 - w$ are weights assigned for each optimization run ($0 \leq w \leq 1$),

$u_1$ is calculated from $\sum_s 1$,

$u_2$ is calculated from $\sum_f \sum_r fv_{max}$,

$o_s$ is the open-site decision variable for each site $s$,

$fv_{sf}$ is the functional value for site $s$ and functional area $f$,

$l_{sfr}$ is the workload assigned to site $s$ for functional area $f$ and test facility category $r$,

$req_{fr}$ is the workload requirement for functional area $f$ and test facility category $r$

TABLE 5.

CONSTRAINT EQUATIONS

$$\sum_s o_s \cdot cap_{sfr} \geq req_{fr}, \text{ for all } f, r$$

$$\sum_s t_{sfr} = req_{fr}, \text{ for all } f, r$$

$$0 \leq t_{sfr} \leq o_s \cdot cap_{sfr}, \text{ for all } s, f, r$$

$$o_s = \{\ 0 \text{ or } 1\ \}, \text{ for all s}$$

$$\sum_f \sum_r t_{sfr} \geq o_s. \text{ for all s}$$

$$\sum_s o_s = n_{limit},$$

where $n_{limit}$ is assigned as a run limit on the number of sites

## ANNEX to Appendix D: Initial Policy Imperatives & Rationale

### 1. INTRODUCTION:

This document describes the policy imperatives to be utilized in T&E cross-service analysis to ensure that essential DoD testing capabilities are retained.

### 2. SCOPE:

The T&E JCSG has developed an initial set of policy imperatives to be used during the various phases of analysis to ensure that the facilities necessary to satisfy the DoD testing requirements, within each of the three T&E functional areas, are retained.

### 3. POLICY IMPERATIVES & RATIONALE:

The following policy imperatives will be utilized:

a. Retain irreplaceable Air, Land, and Sea space.
- At least one sea range and at least one land range.
- Topography - mountainous, forested or jungle, cultivated lowland, and desert.
- Climatology - tropic, arctic, and temperate.

**Rationale:** Certain physical characteristics are essential in order to test systems in the environments in which U.S. Armed Forces will employ them. Such resources are irreplaceable and thus given high weighting. It is imperative that any alternative retain the necessary diversity of these physical characteristics.

b. Retain backup capability to avoid single node failure where cost effective, and to mitigate risk.

**Rationale:** Certain T&E facilities/capabilities may be of such importance that the temporary loss of them would be so detrimental to national security that retention of backup facilities/capabilities is prudent. This imperative ensures the flexibility to apply military judgement as to whether to retain such facilities, as appropriate.

c. Realign/consolidate into existing MRTFB's that have Open Air Ranges (OAR's), where cost effective.

**Rationale:** Because of the irreplaceable nature of OAR's, it is critical that the DoD ensures that none are given up without a thorough review of the risk/benefits involved. This imperative requires the T&E JCSG to generate compelling rationale for recommending that an OAR be offered up as excess. This is not to be construed as protecting all OAR's. Rather, it is ensuring that rigor is applied to any recommendation to release such scarce and irreplaceable resources.

d. Retain the capability to satisfy requirements in each test facility category (TFC) for each functional area to preserve the test process.

**Rationale:** This imperative ensures that DoD retains facilities/capabilities to satisfy testing requirements and preserve the test process. If the final set of alternatives results in the potential closure of all the facilities that provide the sole DoD capability in a particular TFC, this imperative would ensure that that capability was retained [either at the existing location(s) or at a new site] to support DoD requirements.

e. Exclude operational test agencies (OTA's) and dedicated training activities.

**Rationale:** By their nature, activities that provide dedicated training support do not have the technical infrastructure capable of satisfying developmental T&E requirements. Similarly, OTA's are excluded because they do not own facilities. For these reasons, these activities are removed from the analysis to preclude non-feasible solutions.

f. Remove from consideration in each functional area those facilities/capabilities that:

- Are Military Department unique (i.e. requirement only supports one Military Department).
- Have 5% or less of their total workload in that T&E functional area.

**<u>Rationale:</u>** Although a number of facilities may support T&E in one of the three functional areas, some will not have the broad capability, capacity or cross-service applicability to be included in this analysis. For example, reported facilities whose T&E workload is less than 5% of their total are not good cross-service candidates for realignment/consolidation within the three functional areas being addressed. Likewise, facilities that support requirements that are Military Department unique (e.g. shipboard or terrestrial vehicle EC systems) are not good cross-service candidates.

# Appendix E: Questions, Weights, and Scoring Process

## 1. INTRODUCTION:

This appendix provides the questions, weights, and scoring process used by the T&E Joint Cross-Service Group (JCSG) to derive functional value (see Appendix A for a discussion of functional value (FV) methodology and framework). The questions, weights and scoring process provides a quantitative, consistent, and defensible basis for generating T&E functional values for each site/activity in the areas of Air Vehicles, Electronic Combat, and Armament/Weapons testing.

## 2. QUESTIONS:

The questions were developed as a means to assign T&E FV to physical and technical capabilities of each responding site/activity within each of the three functional areas in which it performs work. The questions were derived from the T&E JCSG Data Call of 31 March 1994, and are to be used in the scoring of the T&E FV for common functions at each site/activity.

The data used to answer these questions comes only from the certified data received from each site/activity. Data not used to develop T&E FV will be evaluated in the operational feasibility phase of the study. This is the phase of the evaluation process in which technical and military judgment is exercised to ensure that the required DoD T&E capability is retained for each proposed alternative.

*The actual questions are administratively sensitive and are held separately within an Annex to this Appendix.*

## 3. WEIGHTS:

Weights were approved by the T&E JCSG based on recommendations from the T&E Joint Working Group (JWG). The weights measure relative importance of the site/activity's physical and technical value.

*The actual weights are administratively sensitive and are held separately within an Annex to this Appendix.*

## 4. SCORING PROCESS:

Consistent with the Internal Control Plan, a disciplined and controlled process for scoring and evaluating the data will be used in order to preserve the integrity of the process and to control access to the certified data. The following describes elements of the scoring process:

### A. Scoring by the JWG.

Each functional area -- Air Vehicles, Electronic Combat, and Armament/Weapons -- will be scored by JWG members from each Military Department. JWG members are to be designated in writing by each Military Department BRAC office to the OSD Co-Chairs prior to the start of the scoring process.

JWG members will initially score the T&E questions independently, after which final scores will be jointly developed. At no time will official scoring be conducted without a JWG member from all three Military Departments being present. A consensus approach will be employed, with disagreements resolved by the lead members of the JWG from each Military Department.

### B. The Data.

The data used in the scoring process will be extracted only from hard copies of the certified data call responses provided by the Military Departments. They will provide only one hard copy of each activity's data call response. With this transfer of the data's control, the Office of the Secretary of Defense (OSD) assumes responsibility for the integrity of the information. Due to the sensitive nature of the data, the T&E JCSG will designate an Administrator who will serve as a central control point for the data.

The Administrator will be charged with maintaining the integrity of the data by storing the data, with accompanying questions, weights, score sheets, and computer disks, in a safe to which only the Administrator has access, and by recording the time of the data's "check-out" and to whom it was released. The Administrator will be available to perform this function in a manner that does not adversely affect the efficiency and effectiveness of the scoring process.

**C. Physical Facility.**

Scoring will be done in a common secure area within the Test & Evaluation Center (TEC), where JWG members will have unrestricted access to all the T&E data after check-out by the Administrator. Access to the TEC and T&E JCSG database, will be limited to T&E JCSG and JWG members plus Military Department BRAC personnel as identified, in writing, to the T&E JCSG Co-Chairs, including the OSD appointed administrators. The T&E JCSG and JWG members (as designated above) will have unlimited access to the TEC. During the scoring process, or any other time, no data or working papers will be removed from the secured area of the TEC, with the exception of data taken by official courier to the Tri-Department BRAC group and to the Military BRAC offices.

**D. The Scoring Procedures.**

The score sheets will be maintained and controlled with the data call responses. They shall be initialed by each JWG member when the member conducts the evaluation. There will be at least two reviews of the data. The first review will be for obvious errors and for comprehensiveness of the activity's data call response. This will also serve as an indication of the consistency with which sites/activities interpreted the data call questions.

If clarifications of the data are required, the parent Military Department's BRAC office will obtain the clarification using procedures established by individual Service BRAC process. At least two of the three Military Departments must agree on clarification requests. Requested clarifications can be initially submitted by FAX but must be followed up with a fully certified copy, as required. Memos-to-the-File must be prepared and signed by all three Military Department leads on the JWG to document minor clarifications received via telephone or fax. All changes made to reported data, with an accompanying justification for those changes, shall be transmitted back to the respective BRAC office(s) for any necessary amendments to the official data call response(s).

Some criteria for requesting data clarification are as follows: (1) data are not provided by T&E test facility category; (2) data are missing, inconsistent or incomplete; (3) an inappropriate N/A response was provided; (4) data are not in the correct format, e.g., wrong units; and (5) other errors or trends are contained which would impact the analysis and are agreed to by the JWG lead members or their designee.

The second review will be for the FV official scoring of the certified data. If, during scoring, further clarifications are required, the clarification procedure described above will be followed. Finally, when the scoring process is completed, the data on the scoring sheets be entered into D-PAD software which will be used to facilitate scoring site/activity responses and rolling up scores into functional values for each site/activity. D-PAD is a commercially available product used by the Department of the Army in BRAC-91 and BRAC-93.

Throughout this process the lead members of the JWG from each Military Department will conduct quality reviews, provide guidance and resolve issues and disagreements raised in the scoring process. If necessary, issues and disagreements will be presented to the T&E JCSG for final resolution.

When the above procedures are completed, the JCSG-approved Air Vehicles, Electronic Combat, and Armament/Weapons FV scores for each site/activity will be provided to the Tri-Department BRAC Group as inputs to the optimization model.

Annex: Functional Value Weights, Questions, Points, and Scoring Scales (*To be held:* ***CLOSE HOLD - FOUO***)

# ANNEX to Appendix E: Functional Value Weights, Questions, Points, and Scoring Scales

**1. INTRODUCTION:**

Appendix E provided the scoring process to be used by the T&E JCSG to derive the Functional Value (FV) for T&E sites/activities. This ANNEX provides;

a. The rationale supporting the assignment of the weights and points to be used in the calculation of FV.

b. The weights to be applied to each T&E Test Facility Category (TFC) for the calculation of Technical Value (TV) and to each element of Physical Value (PV) (i.e., Critical Air/Land/Sea Space, Topography, Climate, etc.).

c. The FV questions with the maximum points and scoring method for each question.

**2. DISCUSSION:**

The value of a T&E site/activity is composed of three unique resources:

a. Physical - As described in Appendix A to the basic document, the physical value of a site is comprised of its natural characteristics. These include Critical Air/Land/Sea Space, Topography, Climate, Encroachment, and Environmental characteristics which combine to produce the PV of the site/activity.

b. Technical - As also described in Appendix A to the basic document, the technical value of a site is composed of its man-made characteristics. These include all of the T&E TFC's of Digital Models & Simulations (DM&S), Measurement Facilities (MF), Integration Labs (IL), Hardware-in-the-Loop (HITL) Facilities, Installed Systems Test Facilities (ISTF), and Open Air Ranges (OAR), which combine to produce the TV of the site/activity.

c. People - The personnel who conduct and support the T&E mission provide the intellectual value of the site/activity.

Physical characteristics that are essential for the conduct of test missions are impossible to relocate and consolidate at another site. Therefore, physical characteristics are given higher weighting when determining FV. Technical characteristics, for the most part, were constructed or acquired at a site and can be relocated with varying degrees of cost and difficulty depending upon the complexity of the infrastructure required to support them. Therefore, technical characteristics are given a lower weighting. People are the most mobile resource. They can be moved at lower cost. Reconstitution of the intellectual skills required to support test missions can be accomplished anywhere T&E sites have existed over a period of time. Therefore, this resource is not used in the calculation of FV.

Section 3 below provides the assigned weights and rationale for PV, TV, and their associated elements. Section 4 provides the rationale for the points assigned to each FV question. Figure 1 of Appendix A to the basic document provides a graphic view of how the points and weights are rolled up to obtain FV for a particular Functional Area and site/activity.

## 3. RATIONALE FOR WEIGHTS:

The following paragraphs provide the basis for the T&E JCSG determination of appropriate FV weights.

a. **Physical Value (XX%)** - It is of paramount importance that the DoD retain a sufficient quantity of air, land, and sea space with broad diversity of physical and climatological environments to replicate all geographic regions that the U.S. Armed Forces may be called upon to operate weapons, platforms and sensors. Such a capability must be retained not only for equipment that is currently in the inventory, but also for those under development within the period covered by the FYDP. The DoD must retain the capability to test this equipment while concurrently being sensitive to the development & environmental concerns of the land it is steward of and their regional communities. Such quantities and diversity of space are irreplaceable, and should not be threatened by encroachment from community development or environmental limitations. Therefore PV is given a higher weight to ensure that higher FV is assigned to those sites which most fully satisfy the physical requirements.

(1) Critical Air/Land/Sea Space (XX%) - The requirement for sufficient quantities of space to conduct test operations is considered the strongest driver in the assignment of FV. At some point in time the equipment that has been subjected to a broad battery of focused testing must be fully exercised in realistic operational environments. Such testing areas must be large enough, and at times secure enough, to contain the test and ensure public safety. The availability of DoD space is of particular concern. Therefore, Critical Air/Land/Sea Space was assigned the highest weight.

(2) Topography & Climate (XX% each) - The worldwide employment of U.S. Armed Forces requires that T&E facilities be able to test equipment in the diverse topographies and climatic zones in which they will be employed. No single T&E site/activity may be able to support all required operational environments. Therefore, these two elements were each given a lower weight than the element of Critical Air/Land/Sea Space.

(3) Encroachment & Environment (E&E) (XX% each) - Although very important to the long-term availability of a site, E&E issues were deemed to play a secondary role in the development of FV. The comprehensive impact of these issues will be fully addressed in each Military Department's treatment of the installations where their T&E facilities are located. Furthermore, the large air, land or sea areas that most T&E sites operate in are large enough to enable the site to coordinate with regional planning and regulatory agencies to develop solutions to E&E issues that do not restrict or inhibit a site's ability to fully support its T&E mission. Therefore, E&E issues are not "drivers" in the formulation of T&E FV. Accordingly, the elements E&E were each assigned low weights.

b. **Technical Value (YY%)** - TV elements are typically infrastructure and/or instrumentation dependent. They require a capital investment of some sort to house equipment used for testing equipment - sometimes in controlled environments. Although the elements of TV are very important to the overall value of a site, some are relocatable and can be built anywhere independent of the physical characteristics. However, some of them do depend on the diversity of air, land or sea space and available elevations. For these reasons the T&E JCSG gave TV a lower weight than PV in recognition of its influence on the overall FV of a T&E site/activity.

(1) Digital Modeling & Simulation Facilities (YY%) - DM&S facilities typically consist of computer software and hardware components, and are very transportable and not infrastructure intensive. In some cases they require no more investment than that required for normal office space. Therefore, DM&S facilities were assigned a low weight.

(2) Measurement Facilities (YY%) - In some instances MF are dependent on the physical characteristics of air, land and/or space. They represent a broad spectrum from simple to complex facilities, and can be infrastructure intensive due to the unique design and support requirements of the buildings and structures that support them. Some of these facilities, due to their large size, would be expensive to replicate at another site/activity. Therefore, MF were assigned a medium weight.

(3) Integration Laboratories (YY%) - Although they typically only do integration at the component level, some perform integration functions up to the system level. Most IL facilities are less infrastructure intensive than HITL's and ISTF's, for example, and can be relocated. Therefore, IL were assigned a low weight.

(4) Hardware-in-the-Loop Facilities (YY%) - HITL facilities typically support integration at the more complex sub-systems level. They can also be infrastructure intensive with sizable equipment investments that are integral to the facilities that support them. Therefore, HITL facilities were assigned a medium weight.

(5) Installed Systems Test Facilities (YY%) - ISTF's are typically used to test a fully integrated weapons system platform, and are also infrastructure intensive. Therefore, ISTF's were assigned a medium weight.

(6) Open Air Ranges (YY%) - OAR represent an extensive investment in instrumentation and supporting infrastructure. The value of the instrumentation is driven by quantity and complexity, and is enhanced by the diversity of azimuth and elevation at which it can be placed relative to the air/land/sea space it supports. In most cases it's the OAR that enables a site to take full advantage of its physical characteristics, and ultimately replicate the real world environment. Therefore, OAR facilities were assigned the highest weight for TV.

## 4. RATIONALE FOR THE SCORING SCALES & POINTS TO FUNCTIONAL QUESTIONS:

Attachments 1, 2 & 3 provide the FV questions to be used to score the functional areas of Air Vehicles, Electronic Combat, and Armament/Weapons respectively. The following paragraphs provide the basis for the T&E JCSG determination of appropriate FV points and scoring scales used to score the FV questions.

## a. SCORING SCALES FOR FUNCTIONAL VALUE.

Three types of scoring scales will be used to determine T&E functional values: No/Yes, 0-Max, and 0-Threshold. These scales will be used to determine what portion of the total points available to a given question are credited to a site/activity within a given functional area.

**(1) Yes/No.** This scale is applied to questions for which only a binary response is possible. Depending on the sense of the question, all of the available points will be credited to a "Yes" response with none being credited to a "No" response (e.g., "Is the facility equipped to support TOP SECRET or Special Access work?"); or, all of the available points will be credited to a "No" response (e.g., Does the facility have limiting environmental characteristics?").

**(2) 0-Max.** This scale is applied to questions for which a continuum of responses is possible. Generally, this scoring approach assigns credit on a "bigger is better" basis. For example, "What is the ramp space available?" In this case, the site with the most ramp space will be credited with all the points available to that question. Credit to all other sites will be apportioned linearly (i.e., y = mx), such that a site with half the amount of ramp space as that of the site with the most ramp space will get exactly half of the points available to that question. A site with no ramp space will get no points.

In the "bigger is worse" case, (e.g., "What is the total population inside a 50 mile radius of the facility?"), the site with no population within the 50 mile radius will be credited with all of the points available. The site with the most population will get no credit. For scoring purposes, responses to questions which were cast in the negative sense (bigger is worse) will be converted to the positive sense (bigger is better) prior to application of the 0-Max scoring scale. This will give functional value credit for the inherent positive value of a site's characteristic. For example, responses to "What percent of test missions were canceled due to encroachment in the past two years?" are easily converted to correspond to the more appropriate (from a functional value perspective) question, "What percent of test missions were <u>not</u> canceled due to encroachment in the past two years?"

For all questions related to altitude limits, the Upper Limit is capped at 100K feet since this is the aerodynamic limit for air-related testing.

(3) **0-Threshold.** This scale was used for scoring air, land, and sea to determine the degree to which the DoD requirement (threshold) is satisfied. The threshold is determined based on the requirements of the most demanding weapons systems. Because the majority of weapons systems can be accommodated in a smaller space an exponential scoring relationship [e.g., score = Points X [1- e $^{-(2.3 * Value/Threshold)}$] was judged to be the most appropriate. The 2.3 constant grants 90% of the max points to the facility that has space equal to the threshold. Value is defined from the data call as available space. A linear relationship, as used in the 0-Max approach, could not handle the above situation. In addition, this scoring approach allows credit for expansion capability beyond the threshold.

Because of their unusually large spatial requirements (e.g. footprints) relating to cruise missiles and long-range, theater missile defense weapons (THAAD class) will not be included in the determination of the air, land and sea space thresholds. The capability to test these weapon systems will be evaluated during the operational feasibility assessment and development of concepts of operations for each alternative to ensure that the DoD T&E requirements for these weapons systems are satisfied within the recommended alternatives.

**b. RATIONALE FOR POINTS FOR FUNCTIONAL VALUE QUESTIONS.**

**(1) PHYSICAL VALUE**

**(a) Critical Air/Land/Sea Space**

Critical air/land/sea space is the most important physical value of any other physical subcategory (i.e., topography, climate, encroachment, and environment) because it represents an irreplaceable asset that must be maintained to support/satisfy DoD test requirements within each of the three functional areas -- Air Vehicles, Electronic Combat, and Armament/ Weapons.

**Air Vehicles.** All questions dealing with air, land, and sea space are valued highest, since physical resources are not replaceable (cannot be duplicated). Questions with altitude limits and supersonic airspace were given a medium weighting. The length of straight line segments was considered less significant for air vehicles, and the T&E JCSG gave them low weightings.

**Electronic Combat.** All questions dealing with air, land, and sea space are valued highest, since physical resources are not replaceable (cannot be duplicated). Questions with altitude limits and supersonic airspace were given a medium weighting. The length of straight line segments was not considered significant for Electronic Combat, and the T&E JCSG gave them low weightings.

**Armament/Weapons.** All questions dealing with air, land, and sea space are valued highest, since physical resources are not replaceable (cannot be duplicated). Unlike Air Vehicles and Electronic Combat, maximum straight line range questions are heavily valued for Armaments/Weapons due to the need for long, straight line segments to support maximum energy safety footprints. Of lesser value were altitude and supersonic corridors required for delivery platforms and armaments. Armament/weapons questions deal with restricted air space, to include warning areas, since armament/weapons must be launched within restricted airspace (or warning areas). Also, since armament/weapons must be tested on DoD air, land and sea warning space, the associated question reflects this requirement.

(b) <u>Topography</u>

**Air Vehicles.** All types of land topography are equally valued and, therefore, equally weighted. Sea was given twice as much weight as any one type of land topography due to its importance to the Navy resulting in an apportionment of 70% of the total points to land and 30 % to sea.

**Electronic Combat.** Same as Air Vehicles.

**Armament/Weapons.** Same as Air Vehicles.

(c) <u>Climate</u>

**Air Vehicles.** Two questions were used to define the climatic category. One addresses visibility greater than three miles in order to identify VFR flight conditions and atmospheric conditions which support photo-optic tracking. The other addresses percentage of time test missions are canceled due to weather, which impacts the productivity of a T&E site/activity. To air vehicles, which routinely use VFR conditions, visibility greater than three miles is weighted higher than missions canceled.

**Electronic Combat.** To electronic combat, test missions can be conducted under IFR conditions without adverse impact to mission efficiency or data quality. Therefore, the question regarding visibility greater than three miles was eliminated. The other question addressing the percentage of time test missions are canceled due to weather, was the only question used so it received the full 100 points.

**Armament/Weapons.** Two questions were used to define the climatic category. One addresses visibility greater than three miles in order to identify VFR flight conditions and atmospheric conditions which support photo-optic tracking. The other addresses percentage of time test missions are canceled due to weather. To armament/weapons the questions are equally important.

(d) <u>Encroachment</u>

**Air Vehicles.** Historical test mission impacts due to commercial/public use and encroachment are direct indicators of current encroachment and are weighted twice as high as the indirect/future encroachment indicators related to total population within 50, 100, 150 and 200 miles. The four population radii are apportioned points in a 4:3:2:1 ratio to each other. The highest amount of points is given to the 50 mile radius because it is the strongest indicator of current encroachment levels.

**Electronic Combat.** Same as Air vehicles.

**Armament/Weapons.** Same as Air Vehicles.

(e) <u>Environmental</u>

**Air Vehicles.** One question addresses the environmental limitations and receives 100% of the points. As stated in Section 3.a.(3), the comprehensive impact of environmental issues will be fully addressed in each Military Department's treatment of the installation on which their T&E facilities are located.

**Electronic Combat.** Same as Air Vehicles.

**Armament/Weapons.** Same as Air Vehicles.

(2) TECHNICAL VALUE

(a) <u>Digital Models and Simulations</u>

**Air Vehicles.** The site/activity's possession of a DM&S facility was given the bulk of the points because the facility provides important technical capabilities in the support of test operations. Less value (and points) are associated with the irreparable harm, top secret/special access, and specialized facilities questions.

**Electronic Combat.** Same as Air Vehicles.

**Armament/Weapons.** Same as Air Vehicles.

(b) Measurement Facilities

**Air Vehicles.** The site's/activity's possession of a measurement facility was given the bulk of the points because the facility provides important technical capabilities in the support of test operations. Less value (and points) are associated with the irreparable harm, top secret/special access, and specialized facilities questions.

**Electronic Combat.** The question regarding specific spectra to test against drives, to a large extent, the value of a given facility (replacement cost), as well as whether EC testing can be done at one location or work must be distributed among many, which is more costly and the data is difficult to correlate. Therefore, the majority of the value (and points) are associated with the technical capabilities. Less value (and points) are associated with the irreparable harm, top secret/special access, and specialized facilities questions.

**Armament/Weapons.** The majority of the value (and points) are associated with the ten technical capabilities for armament/weapons, since the facilities are significant cost drivers. Specific technical test areas are equally weighted.

(c) Integration Laboratories

**Air Vehicles.** The site/activity's possession of an Integration Laboratory was given the bulk of the points because the facility provides important technical capabilities in the support of test operations. Less value (and points) are associated with the irreparable harm, top secret/special access, and specialized facilities questions.

**Electronic Combat.** Same as Air Vehicles.

**Armament/Weapons.** Same as Air Vehicles.

(d) Hardware-in-the-Loop Capabilities

**Air Vehicles.** The site/activity's possession of a Hardware-in-the-Loop facility was given the bulk of the points because the facility provides important technical capabilities in the support of test operations. Less value (and points) are associated with the irreparable harm, top secret/special access, and specialized facilities questions.

**Electronic Combat.** Questions 1 and 2 are weighted higher because they are the primary cost and capability drivers for HITL capabilities (question 1 more so than question 2, as additional labs are generally required for additional spectra). Less value (and points) are associated with the irreparable harm, top secret/special access, and specialized facilities questions.

**Armament/Weapons.** As with EC, the majority of the value (and points) are associated with the frequency spectrum of HITL labs which significantly drive the value of a facility and the replacement cost to meet the technical capabilities for armament/weapons. Specific technical test areas (spectra) are equally weighted. Less value (and points) are associated with the irreparable harm, top secret/special access, and specialized facilities questions.

(e) <u>Installed Systems Test Facilities</u>

**Air Vehicles.** Size is the major cost driver for an ISTF. Questions related to size were weighted highest. Less value (and points) are associated with the irreparable harm, top secret/special access, and specialized facilities questions.

**Electronic Combat.** The majority of the value and points are associated with the required technical capabilities (i.e., spectra tested against, threat signals, and size/weight limitations) since they are the primary cost and capability drivers for ISTF's. Technical questions and sub-questions are evenly weighted. Of less value and points are the questions associated with test types and higher than irreparable harm, top secret/special access, and specialized facilities questions.

**Armament/Weapons.** Same as Electronic Combat.

(f) <u>Open Air Ranges</u>

**Air Vehicles.** OAR facilities comprise the most important technical value category for air vehicle testing. The site's ability to conduct the four types of air vehicle testing reflects overall technical infrastructure. This was judged highest and received the most points. Instrumentation to support simultaneous missions requiring telemetry is an indicator of the extent of instrument resources necessary to support tests. Instrumentation was felt to be the next most important category and therefore given the next highest weight. The length of runway, ramp area available, and hangar space are of lower importance. TOP SECRET/Special Access Required is not a major capability or cost driver for an OAR and therefore receives less points.

**Electronic Combat.** In addition to required physical attributes, the primary drivers behind an OAR's capability and cost are threat simulators and instrumentation. These assets are the topics for questions 1 through 7 (question 7 actually combines attributes of physical and technical threat simulator capabilities). Questions 8, 9 and 10 are not major capability or cost drivers for an OAR and therefore receive less points.

Additionally, question 2 (although appearing redundant to the sum of questions 3 through 6) is necessary because some threat simulators are electronically able to simulate more than one type of threat, but not simultaneously. Thus, question 2 provides information concerning overall signal density, while questions 3 through 6 address specific types of threats (question 6 being related primarily to early warning, ground controlled intercept, acquisition, and command and control threats, and the other questions to categories of actual shooters.)

**Armament/Weapons.** Maximum value and points are again associated with the primary cost and capability drivers associated with the technical capabilities of an OAR. The types of armament/weapon tests which a site/activity conducts/schedules are the highest value technical questions, since ability to conduct/schedule a cross-section of Armament/ Weapons tests is an indicator of infrastructure capability, completeness, and quality. The individual (specific) types of tests are equally weighted. Validated targets and maximum number of simultaneous missions requiring telemetry are valued lower than the capability associated with test types and higher than Irreparable Harm, TOP SECRET/Special Access Required, and support facilities, since the cost of targets and simultaneous telemetry capabilities falls between the two groups.

# ATTACHMENT 1
# TO THE ANNEX OF APPENDIX E

## FUNCTIONAL VALUE QUESTIONS & WEIGHTS FOR
# AIR VEHICLES

# AIR VEHICLE
# FUNCTIONAL VALUE QUESTIONS

| No. | Capabilities/Questions | Points | Scoring Method |
|---|---|---|---|
| **1.0** | **Physical Value** | | |
| **1.1** | **Critical Air/Land/Sea Space** | **100 Total** | |
| 1.1.1 | How many square miles of land space are available to support test operations? (3.1.G.1) | 15 | 0-Threshold |
| 1.1.2 | How many square miles of sea space are available to support test operations? (3.1.G.1) | 15 | 0-Threshold |
| 1.1.3 | How much of the land under the restricted airspace does DoD own or control? (3.1.G.2) | | |
| | a. None | 0 | N/Y |
| | b. Some | 2 | N/Y |
| | c. All | 5 | N/Y |
| 1.1.4 | How many square miles of restricted airspace (including warning areas) are available to support test operations? (3.1.G.3) | 15 | 0-Threshold |
| 1.1.5 | What altitude limits are associated with the restricted airspace (including warning areas)? (Upper Limit-Lower Limit) Upper limit is capped at 100k feet. (3.1.G.3) | 7 | 0-Max |
| 1.1.6 | How many square miles of available airspace are over land? (3.1.G.5) | 7.5 | 0-Threshold |

| | | | |
|---|---|---|---|
| 1.1.7 | How many square miles of available airspace are over water? (3.1.G.5) | 7.5 | 0-Threshold |
| 1.1.8 | What is the maximum straight line segment in the airspace, in nautical miles? (3.1.G.7) | 2.5 | 0-Threshold |
| 1.1.9 | Do supersonic areas and/or corridors exist? (3.2.A.1) | 7 | N/Y |
| 1.1.10 | What altitude limits are associated with the supersonic airspace? (Upper Limit-Lower Limit) Upper limit is capped at 100k feet. (3.2.A.3) | 7 | 0-Max |
| 1.1.11 | What is the maximum straight line segment in the supersonic airspace, in nautical miles? (3.2.A.4) | 2.5 | 0-Threshold |
| 1.1.12 | What is the minimum altitude allowable in the restricted airspace (including Warning Areas) (3.1.G.3) | 7 | Max-0 |
| **1.2** | **Topographical** | **100 Total** | |
| 1.2.1 | Which of the following types of topography and ground cover/vegetation exist within your test airspace? (3.1.H.1) | | |
| | a. Mountainous | 14 | N/Y |
| | b. Forested or jungle | 14 | N/Y |
| | c. Cultivated lowland (farmland) | 14 | N/Y |
| | d. Swamp or riverine | 14 | N/Y |
| | e. Desert | 14 | N/Y |
| | f. Sea | 30 | N/Y |

| | | | |
|---|---|---|---|
| **1.3** | **Climatic** | **100 Total** | |
| 1.3.1 | What is the average percentage of days per year that visibility is greater than 3 miles? (3.1.H.8) | 60 | 0-Max |
| 1.3.2 | What is the percent of test missions ,1986 - 1993, not canceled due to weather? (3.1.H.6) | 40 | 0-Max |
| **1.4** | **Encroachment** | **100 Total** | |
| 1.4.1 | What is the average percentage of test missions per year not canceled due to commercial or public use ? [100% minus (% derived from # of test missions canceled divided by the # of test missions over period reported)] (3.1.C.5.A, Data Forms) | 35 | 0-Max |
| 1.4.2 | What percent of test missions were not canceled due to encroachment in the past two years [100% minus (% derived from sum of 92 and 93 canceled missions divided by the sum of 92 and 93 test missions)] (3.1.C.6, Data Forms) | 35 | 0-Max |
| 1.4.3 | What is the total population inside tne following radii of the facility? (3.1.C.4) | | |
| | a. 50 miles | 12 | Max-0 |
| | b. 100 miles | 9 | Max-0 |
| | c. 150 miles | 6 | Max-0 |
| | d. 200 miles | 3 | Max-0 |
| **1.5** | **Environment** | **100 Total** | |
| 1.5.1 | Does the facility have limiting environmental characteristics? (3.1.C.1.) | 100 | Y/N |

## 2.0 Technical Value

| | | | |
|---|---|---|---|
| **2.1** | **Digital Models and Simulations (DM&S)** | **100 Total** | |
| 2.1.1 | Do you have a DM&S facility that supports test operations? (General Information Form) | 90 | N/Y |
| 2.1.2 | Does the facility provide a T&E product or service without which irreparable harm would be imposed on any mission (other than test) deemed critical to the operational effectiveness of the armed forces of the US? (2.3.B.2) | 5 | N/Y |
| 2.1.3 | Is the facility equipped to support Top Secret or Special Access Required work? (3.1.E.3) | 3 | N/Y |
| 2.1.4 | Does the facility have specialized facilities to support conduct of test operations? (3.1.D.1) | 2 | N/Y |
| **2.2** | **Measurement Facilities (MF)** | **100 Total** | |
| 2.2.1 | Do you have a MF facility that supports test operations? (General Information Form) | 90 | N/Y |
| 2.2.2 | Does the facility provide a T&E product or service without which irreparable harm would be imposed on any mission (other than test) deemed critical to the operational effectiveness of the armed forces of the US? (2.3.B.2) | 5 | N/Y |
| 2.2.3 | Is the facility equipped to support TOP SECRET or Special Access Required work? (3.1.E.3) | 3 | N/Y |
| 2.2.4 | Do you have specialized facilities which are required to support you in conducting your test operations at your facility? (3.1.D.1) | 2 | N/Y |

| | | | |
|---|---|---|---|
| **2.3** | **Integration Labs (IL)** | **100 Total** | |
| 2.3.1 | Do you have an IL facility that supports test operations? (General Information Form) | 90 | N/Y |
| 2.3.2 | Does the facility provide a T&E product or service without which irreparable harm would be imposed on any mission (other than test) deemed critical to the operational effectiveness of the armed forces of the US? (2.3.B.2) | 5 | N/Y |
| 2.3.3 | Is the facility equipped to support Top Secret or Special Access Required work? (3.1.E.3) | 3 | N/Y |
| 2.3.4 | Does the facility have specialized facilities to support conduct of test operations? (3.1.D.1) | 2 | N/Y |
| **2.4** | **Hardware-In-The-Loop (HITL)** | **100 Total** | |
| 2.4.1 | Do you have a HITL facility that supports test operations? (General Information Form) | 90 | N/Y |
| 2.4.2 | Does the facility provide a T&E product or service without which irreparable harm would be imposed on any mission (other than test) deemed critical to the operational effectiveness of the armed forces of the US? (2.3.B.2) | 5 | N/Y |
| 2.4.3 | Is the facility equipped to support Top Secret or Special Access Required work? (3.1.E.3) | 3 | N/Y |
| 2.4.4 | Does the facility have specialized facilities to support conduct of test operations? (3.1.D.1) | 2 | N/Y |

| | | | |
|---|---|---|---|
| **2.5** | **Installed Systems Test Facilities (ISTF)** | **100 Total** | |
| 2.5.1 | Can the facility support fighter/helo-sized aircraft testing? (3.2.C.3 & Fac form) | 45 | N/Y |
| 2.5.2 | Can the facility support B-1 bomber/cargo-sized aircraft testing? (3.2.C.3 & Fac form) | 45 | N/Y |
| 2.5.3 | Does the facility provide a T&E product or service without which irreparable harm would be imposed on any mission (other than test) deemed critical to the operational effectiveness of the armed forces of the US? (2.3.B.2) | 5 | N/Y |
| 2.5.4 | Is the facility equipped to support TOP SECRET or Special Access Required work? (3.1.E.3) | 3 | N/Y |
| 2.5.5 | Do you have specialized facilities which are required to support you in conducting your test operations at your facility? (3.1.D.1) | 2 | N/Y |
| **2.6** | **Open Air Ranges (OAR)** | **100 Total** | |
| 2.6.1 | Which of the following types of air vehicles can be tested: (3.2.C.1) | | |
| | a. fixed wing? | 7 | N/Y |
| | b. rotary wing? | 7 | N/Y |
| | c. unmanned? | 7 | N/Y |
| | d. cruise missile? | 7 | N/Y |
| 2.6.2 | What is the maximum number of simultaneous missions you can support with telemetry? (3.2.C.6) | 22 | 0-Max |

| | | | |
|---|---|---|---|
| 2.6.3 | What is the length (in feet) of available concrete runway? (3.2.B.1) | 10 | 0-Max |
| 2.6.4 | What is the ramp area available (in sq ft)? (3.2.B.1) | 10 | 0-Max |
| 2.6.5 | What is the hangar space available (in sq ft)? (3.2.B.1 | 10 | 0-Max |
| 2.6.6 | Are ground facilities available to support preflight checkout and/or rehearsal of test missions? (3.2.C.2) | 10 | N/Y |
| 2.6.7 | Does the facility provide a T&E product or service without which irreparable harm would be imposed on any mission (other than test) deemed critical to the operational effectiveness of the armed forces of the US? (2.3.B.2) | 5 | N/Y |
| 2.6.8 | Is the facility equipped to support TOP SECRET or Special Access Required work? (3.1.E.3) | 3 | N/Y |
| 2.6.9 | Do you have specialized facilities which are required to support you in conducting your test operations at your facility? (3.1.D.1) | 2 | N/Y |

# ATTACHMENT 2
# TO THE ANNEX OF APPENDIX E

# FUNCTIONAL VALUE QUESTIONS & WEIGHTS FOR
# ELECTRONIC COMBAT

# ELECTRONIC COMBAT FUNCTIONAL VALUE QUESTIONS

| No. | Capabilities/Questions | Points | Scoring Method |
|---|---|---|---|
| **1.0** | **Physical Value** | | |
| **1.1** | **Critical Air/Land/Sea Space** | **100 Total** | |
| 1.1.1 | How many square miles of land space are available to support test operations? (3.1.G.1) | 16 | 0-Threshold |
| 1.1.2 | How many square miles of sea space are available to support test operations? (3.1.G.1) | 16 | 0-Threshold |
| 1.1.3 | How much of the land under the restricted airspace (including warning areas) does DoD own or control? (3.1.G.2) | | |
| | a. None | 0 | N/Y |
| | b. Some | 3 | N/Y |
| | c. All | 5 | N/Y |
| 1.1.4 | How many square miles of restricted airspace (including warning areas) are available to support test operations? (3.1.G.3) | 15 | 0-Threshold |
| 1.1.5 | What altitude limits are associated with the restricted airspace (including warning areas)? (Upper Limit-Lower Limit) Upper limit is capped at 100k feet. (3.1.G.3) | 8 | 0-Max |
| 1.1.6 | What is the minimum altitude allowable in the restricted airspace (including warning areas)? (3.1.G.3) | 8 | Max-0 |

| | | | |
|---|---|---|---|
| 1.1.7 | How many square miles of available airspace are over land? (3.1.G.5) | 10 | 0-Threshold |
| 1.1.8 | How many square miles of available airspace are over water? (3.1.G.5) | 6 | 0-Threshold |
| 1.1.9 | What is the maximum straight line segment in the airspace, in nautical miles? (3.1.G.7) | 5 | 0-Threshold |
| 1.1.10 | Do supersonic areas and/or corridors exist? (3.2.A.1) | 8 | N/Y |
| **1.2** | **Topographical** | **100 Total** | |
| 1.2.1 | Which of the following types of topography and ground cover/vegetation exist within your test airspace? (3.1.H.1) | | |
| | a. Mountainous | 14 | N/Y |
| | b. Forested or jungle | 14 | N/Y |
| | c. Cultivated lowland (farmland) | 14 | N/Y |
| | d. Swamp or riverine | 14 | N/Y |
| | e. Desert | 14 | N/Y |
| | f. Sea | 30 | N/Y |
| **1.3** | **Climatic** | **100 Total** | |
| 1.3.1 | What is the average percentage of test missions per year not canceled due to weather? (3.1.H.6, Data Forms) [100% minus (% derived from # of test missions canceled in FY86-93 divided by # of test missions FY86-93)] | 100 | 0-Max |

| | | | |
|---|---|---|---|
| **1.4** | **Encroachment** | **100 Total** | |
| 1.4.1 | What is the average percentage of test missions per year not canceled due to commercial or public use ? [100% minus (% derived from # of test missions canceled divided by the # of test missions over period reported)] (3.1.C.5.A, Data Forms) | 35 | 0-Max |
| 1.4.2 | What percent of test missions were not canceled due to encroachment in the past two years [100% minus (% derived from sum of 92 and 93 canceled missions divided by the sum of 92 and 93 test missions)] (3.1.C.6, Data Forms) | 35 | 0-Max |
| 1.4.3 | What is the total population inside the following radii of the facility? (3.1.C.4) | | |
| | a. 50 miles | 12 | Max-0 |
| | b. 100 miles | 9 | Max-0 |
| | c. 150 miles | 6 | Max-0 |
| | d. 200 miles | 3 | Max-0 |
| **1.5** | **Environment** | **100 Total** | |
| 1.5.1 | Does the facility have limiting environmental characteristics? (3.1.C.1.) | 100 | Y/N |
| **2.0** | **Technical Value** | | |
| **2.1** | **Digital Models and Simulations (DM&S)** | **100 Total** | |
| 2.1.1 | Do you have a DM&S facility that supports test operations? (General Information Form) | 90 | N/Y |

| | | | |
|---|---|---|---|
| 2.1.2 | Does the facility provide a T&E product or service without which irreparable harm would be imposed on any mission (other than test) deemed critical to the operational effectiveness of the armed forces of the US? (2.3.B.2) | 5 | N/Y |
| 2.1.3 | Is the facility equipped to support Top Secret or Special Access Required work? (3.1.E.3) | 3 | N/Y |
| 2.1.4 | Does the facility have specialized facilities to support conduct of test operations? (3.1.D.1) | 2 | N/Y |
| **2.2** | **Measurement Facilities (MF)** | **100 Total** | |
| 2.2.1 | Which of the following spectra are available to test against (3.3.A.2, 3.3.B.4): | | |
| | a. RF | 15 | N/Y |
| | b. EO | 15 | N/Y |
| | c. IR | 15 | N/Y |
| | d. MMW | 15 | N/Y |
| | e. UV | 15 | N/Y |
| | f. Laser? | 15 | N/Y |
| 2.2.2 | Does the facility provide a T&E product or service without which irreparable harm would be imposed on any mission (other than test) deemed critical to the operational effectiveness of the armed forces of the US? (2.3.B.2) | 5 | N/Y |
| 2.2.3 | Is the facility equipped to support Top Secret or Special Access Required work? (3.1.E.3) | 3 | N/Y |

| | | | |
|---|---|---|---|
| 2.2.4 | Does the facility have specialized facilities to support conduct of test operations? (3.1.D.1) | 2 | N/Y |
| **2.3** | **Integration Labs (IL)** | **100 Total** | |
| 2.3.1 | Do you have an IL facility that supports test operations? (General Information Form) | 90 | N/Y |
| 2.3.2 | Does the facility provide a T&E product or service without which irreparable harm would be imposed on any mission (other than test) deemed critical to the operational effectiveness of the armed forces of the US? (2.3.B.2) | 5 | N/Y |
| 2.3.3 | Is the facility equipped to support Top Secret or Special Access Required work? (3.1.E.3) | 3 | N/Y |
| 2.3.4 | Does the facility have specialized facilities to support conduct of test operations? (3.1.D.1) | 2 | N/Y |

| | | | |
|---|---|---|---|
| **2.4** | **Hardware-In-The-Loop (HITL)** | **100 Total** | |
| 2.4.1 | Which of the following spectra are available to test against (3.3.A.2, 3.3.B.4): | | |
| | a. RF | 10 | N/Y |
| | b. EO | 10 | N/Y |
| | c. IR | 10 | N/Y |
| | d. MMW | 10 | N/Y |
| | e. UV | 10 | N/Y |
| | f. Laser? | 10 | N/Y |
| 2.4.2 | Does the facility have closed-loop threat simulators? (3.3.A.4) | 30 | N/Y |
| 2.4.3 | Does the facility provide a T&E product or service without which irreparable harm would be imposed on any mission (other than test) deemed critical to the operational effectiveness of the armed forces of the US? (2.3.B.2) | 5 | N/Y |
| 2.4.4 | Is the facility equipped to support TOP SECRET or Special Access Required work? (3.1.E.3) | 3 | N/Y |
| 2.4.5 | Are specialized facilities available to support EC test operations? (3.1.D.1) | 2 | N/Y |

| | | | |
|---|---|---|---|
| **2.5** | **Installed Systems Test Facilities (ISTF)** | **100 Total** | |
| 2.5.1 | Which of the following spectra are available to test against (3.3.A.2, 3.3.B.4): | | |
| | a. RF | 6 | N/Y |
| | b. EO | 6 | N/Y |
| | c. IR | 6 | N/Y |
| | d. MMW | 6 | N/Y |
| | e. UV | 6 | N/Y |
| | f. Laser? | 6 | N/Y |
| 2.5.2 | Are radio frequency threat signals: (3.3.A.2) | | |
| | a. radiated? | 9 | N/Y |
| | b. injected? | 9 | N/Y |
| 2.5.3 | Can the facility support fighter/helicopter-sized aircraft testing? (3.3.B.1) | 18 | N/Y |
| 2.5.4 | Can the facility support B-1 bomber/cargo-sized aircraft testing? (3.3.B.1) | 18 | N/Y |
| 2.5.5 | Does the facility provide a T&E product or service without which irreparable harm would be imposed on any mission (other than test) deemed critical to the operational effectiveness of the armed forces of the US? (2.3.B.2) | 5 | N/Y |
| 2.5.6 | Is the facility equipped to support Top Secret or Special Access Required work? (3.1.E.3) | 3 | N/Y |

| | | | |
|---|---|---|---|
| 2.5.7 | Does the facility have specialized facilities to support conduct of test operations? (3.1.D.1) | 2 | N/Y |
| **2.6** | **Open Air Ranges (OAR)** | **100 Total** | |
| 2.6.1 | How many of the following spectra are available to test against (3.3.A.2, 3.3.B.4): | | |
| | a. RF | 3 | N/Y |
| | b. EO | 3 | N/Y |
| | c. IR | 3 | N/Y |
| | d. MMW | 3 | N/Y |
| | e. UV | 3 | N/Y |
| | f. Laser? | 3 | N/Y |
| 2.6.2 | How many simultaneous threats can be simulated? (3.3.A.2) | 11 | 0-Max |
| 2.6.3 | How many surface-to-air missile threats can be simulated simultaneously? (3.3.A.2) | 11 | 0-Max |
| 2.6.4 | How many airborne interceptor threats can be simulated simultaneously? (3.3.A.2) | 11 | 0-Max |
| 2.6.5 | How many anti-aircraft artillery threats can be simulated simultaneously? (3.3.A.2) | 11 | 0-Max |
| 2.6.6 | Other than in questions 2.6.3, 2.6.4, and 2.6.5 above, how many other threats can be simulated simultaneously? (3.3.A.2) | 11 | 0-Max |
| 2.6.7 | What is the geographic dispersion (width x depth, in NM) of available threat simulators? (3.3.A.7) | 11 | 0-Max |

| | | | |
|---|---|---|---|
| 2.6.8 | Is the facility equipped to support TOP SECRET or Special Access Required work? (3.1.E.3) | 9 | N/Y |
| 2.6.9 | Does the facility provide a T&E product or service without which irreparable harm would be imposed on any mission (other than test) deemed critical to the operational effectiveness of the armed forces of the US? (2.3.B.2) | 5 | N/Y |
| 2.6.10 | Are specialized facilities available to support EC test operations? (3.1.D.1) | 2 | N/Y |

# ATTACHMENT 3
# TO THE ANNEX OF APPENDIX E

# FUNCTIONAL VALUE QUESTIONS & WEIGHTS FOR
# ARMAMENT/WEAPONS

# ARMAMENT/WEAPONS FUNCTIONAL VALUE QUESTIONS

| No. | Capabilities/Questions | Points | Scoring Method |
|---|---|---|---|
| **1.0** | **Physical Value** | | |
| **1.1** | **Critical Air/Land/Sea Space** | **100 Total** | |
| 1.1.1 | How many square miles of restricted air space (including warning areas) are available to support test operations? (3.1.G.3, 3.1.G.4, Data Forms) | 15 | 0-Threshold |
| 1.1.2 | How many square miles of DoD land space are available to support test operations? (3.1.G.1, 3.1.G.2, 3.4.B.1.A, Data Forms) | 15 | 0-Threshold |
| 1.1.3 | How many square miles of sea warning area space are available to support test operations? (3.1.G.1, 3.1.G.4, 3.4.B.1.A, Data Forms) | 15 | 0-Threshold |
| 1.1.4 | What is the maximum straight line range (in nautical miles) that the site can use to test the following? (3.1.G.7, 3.4.B.1.C, Data Forms) | | |
| | a. Air-to-air missiles | 10 | 0-Threshold |
| | b. Air-to-surface weapons | 10 | 0-Threshold |
| | c. Surface-to-air missiles | 10 | 0-Threshold |

| | | | |
|---|---|---|---|
| 1.1.5 | What altitude limits are associated with restricted airspace (including warning areas)? [Upper Limit - Lower Limit] Upper limit is capped at 100k feet. (3.1.G.3, 3.1.G.4, Data Forms) | | |
| | a. Over land | 5 | 0-Max |
| | b. Over sea | 5 | 0-Max |
| 1.1.6 | What is the largest supersonic area? [length X width in nautical miles] (3.2.A.4, Data Forms) | 10 | 0-Threshold |
| 1.1.7 | What is the minimum to maximum altitude within the supersonic corridor or area which is used to conduct testing? [Upper Limit - Lower Limit] Upper limit is capped at 100k feet. (3.2.A.3, Data Forms) | 5 | 0-Max |
| **1.2** | **Topographical** | **100 Total** | |
| 1.2.1 | Which of the following types of topography and ground cover/vegetation exist within your test airspace? (3.1.H.1) | | |
| | a. Mountainous | 14 | N/Y |
| | b. Forested or jungle | 14 | N/Y |
| | c. Cultivated lowland (farmland) | 14 | N/Y |
| | d. Swamp or riverine | 14 | N/Y |
| | e. Desert | 14 | N/Y |
| | f. Sea | 30 | N/Y |

| | | | |
|---|---|---|---|
| **1.3** | **Climatic** | **100 Total** | |
| 1.3.1 | What is the average number of days per year (1985-1993) the visibility is greater than 3 miles? (3.1.H.8, Data Forms) | 50 | 0-Max |
| 1.3.2 | What is the average percentage of test missions per year not canceled due to weather? (3.1.H.6, Data Forms) [100% minus (% derived from # of test missions canceled in FY86-93 divided by # of test missions FY86-93)] | 50 | 0-Max |
| **1.4** | **Encroachment** | **100 Total** | |
| 1.4.1 | What is the average percentage of test missions per year not canceled due to commercial or public use ? [100% minus (% derived from # of test missions canceled divided by the # of test missions over period reported)] (3.1.C.5.A, Data Forms) | 35 | 0-Max |
| 1.4.2 | What percent of test missions were not canceled due to encroachment in the past two years [100% minus (% derived from sum of 92 and 93 canceled missions divided by the sum of 92 and 93 test missions)] (3.1.C.6, Data Forms) | 35 | 0-Max |
| 1.4.3 | What is the total population inside the following radii of the facility? (3.1.C.4) | | |
| | a. 50 miles | 12 | Max-0 |
| | b. 100 miles | 9 | Max-0 |
| | c. 150 miles | 6 | Max-0 |
| | d. 200 miles | 3 | Max-0 |

| | | | |
|---|---|---|---|
| **1.5** | **Environment** | **100 Total** | |
| 1.5.1 | Does the facility have limiting environmental characteristics? (3.1.C.1.) | 100 | Y/N |

## 2.0 Technical Value

| | | | |
|---|---|---|---|
| **2.1** | **Digital Models and Simulations (DM&S)** | **100 Total** | |
| 2.1.1 | Do you have a DM&S facility that supports test operations? (General Information Form) | 90 | N/Y |
| 2.1.2 | Does the facility provide a T&E product or service without which irreparable harm would be imposed on any mission (other than test) deemed critical to the operational effectiveness of the armed forces of the US? (2.3.B.2) | 5 | N/Y |
| 2.1.3 | Is the facility equipped to support Top Secret or Special Access Required work? (3.1.E.3) | 3 | N/Y |
| 2.1.4 | Does the facility have specialized facilities to support conduct of test operations? (3.1.D.1) | 2 | N/Y |

| | | | |
|---|---|---|---|
| **2.2** | **Measurement Facilities (MF)** | **100 Total** | |
| 2.2.1 | Site's armament/weapons T&E measurement facilities conduct which of the following? (3.1.D.1, Data Forms) | | |
| | a. Environmental T&E | 9 | N/Y |
| | b. Safety T&E | 9 | N/Y |
| | c. Warhead performance T&E | 9 | N/Y |
| | d. Fuze T&E | 9 | N/Y |
| | e. Seeker, sensor and guidance/control performance and target/background signature characterization | 9 | N/Y |
| | f. Propulsion performance T&E | 9 | N/Y |
| | g. Airframe/aerodynamic/aerothermal performance T&E across subsonic, transonic, and hypersonic regimes | 9 | N/Y |
| | h. Gun performance T&E | 9 | N/Y |
| | i. Electromagnetic Environmental Effects | 9 | N/Y |
| | j. Directed energy | 9 | N/Y |
| 2.2.2 | Does the facility provide a T&E product or service without which irreparable harm would be imposed on any mission (other than test) deemed critical to the operational effectiveness of the armed forces of the US? (2.3.B.2) | 5 | N/Y |
| 2.2.3 | Is the facility equipped to support Top Secret or Special Access Required work? (3.1.E.3) | 3 | N/Y |
| 2.2.4 | Does the facility have specialized facilities to support conduct of test operations? (3.1.D.1) | 2 | N/Y |

| | | | |
|---|---|---|---|
| **2.3** | **Integration Labs (IL)** | **100 Total** | |
| 2.3.1 | Do you have an IL facility that supports test operations? (General Information Form) | 90 | N/Y |
| 2.3.2 | Does the facility provide a T&E product or service without which irreparable harm would be imposed on any mission (other than test) deemed critical to the operational effectiveness of the armed forces of the US? (2.3.B.2) | 5 | N/Y |
| 2.3.3 | Is the facility equipped to support Top Secret or Special Access Required work? (3.1.E.3) | 3 | N/Y |
| 2.3.4 | Does the facility have specialized facilities to support conduct of test operations? (3.1.D.1) | 2 | N/Y |
| **2.4** | **Hardware-In-The-Loop (HITL)** | **100 Total** | |
| 2.4.1 | Does the facility provide armament/weapons HITL T&E capabilities in the following areas? (3.3.B.4, Data Forms): | | |
| | a. RF | 15 | N/Y |
| | b. IR | 15 | N/Y |
| | c. Laser | 15 | N/Y |
| | d. MMW | 15 | N/Y |
| | e. EO/visible | 15 | N/Y |
| | f. Midcourse Inertial/GPS | 15 | N/Y |
| 2.4.2 | Does the facility provide a T&E product or service without which irreparable harm would be imposed on any mission (other than test) deemed critical to the operational effectiveness of the armed forces of the US? (2.3.B.2) | 5 | N/Y |

| | | | |
|---|---|---|---|
| 2.4.3 | Is the facility equipped to support Top Secret or Special Access Required work? (3.1.E.3) | 3 | N/Y |
| 2.4.4 | Does the facility have specialized facilities to support conduct of test operations? (3.1.D.1) | 2 | N/Y |
| **2.5** | **Installed Systems Test Facilities (ISTF)** | **100 Total** | |
| 2.5.1 | Which of the following spectra are available to test against? (3.3.A.2, 3.3.B.4) | | |
| | a. RF | 6 | N/Y |
| | b. EO | 6 | N/Y |
| | c. IR | 6 | N/Y |
| | d. MMW | 6 | N/Y |
| | e. UV | 6 | N/Y |
| | f. Laser | 6 | N/Y |
| 2.5.2 | Are radio frequency threat signals: (3.3.A.2) | | |
| | a. radiated? | 9 | N/Y |
| | b. injected? | 9 | N/Y |
| 2.5.3 | Can the facility support fighter/helicopter-sized aircraft testing? (3.3.B.1) | 18 | N/Y |
| 2.5.4 | Can the facility support B-1 bomber/cargo-sized aircraft testing? (3.3.B.1) | 18 | N/Y |

| | | | |
|---|---|---|---|
| 2.5.5 | Does the facility provide a T&E product or service without which irreparable harm would be imposed on any mission (other than test) deemed critical to the operational effectiveness of the armed forces of the US? (2.3.B.2) | 5 | N/Y |
| 2.5.6 | Is the facility equipped to support Top Secret or Special Access Required work? (3.1.E.3) | 3 | N/Y |
| 2.5.7 | Does the facility have specialized facilities to support conduct of test operations? (3.1.D.1) | 2 | N/Y |
| **2.6** | **Open Air Ranges (OAR)** | **100 Total** | |
| 2.6.1 | Which of the following types of tests can the site schedule? (3.4.B.2.A) | | |
| | a. Unguided 2000-lb class ballistic weapons | 14 | N/Y |
| | b. Guided weapons | 14 | N/Y |
| | c. Stand-off weapons | 14 | N/Y |
| | d. Short-range missiles | 14 | N/Y |
| | e. Long-range missiles | 14 | N/Y |
| 2.6.2 | Does the facility provide the following validated targets? (3.1.D.2, 3.1.D.2.A) | | |
| | a. Specialized land targets | 5 | N/Y |
| | b. Specialized airborne targets | 5 | N/Y |
| 2.6.3 | What is the maximum number of simultaneous missions the facility can support that require telemetry? (3.2.C.6) | 10 | 0-Max |

| | | | |
|---|---|---|---|
| 2.6.4 | Does the facility provide a T&E product or service without which irreparable harm would be imposed on any mission (other than test) deemed critical to the operational effectiveness of the armed forces of the US? (2.3.B.2) | 5 | N/Y |
| 2.6.5 | Is the facility equipped to support Top Secret or Special Access Required work? (3.1.E.3) | 3 | N/Y |
| 2.6.6 | Does the facility have specialized facilities to support conduct of test operations? (3.1.D.1) | 2 | N/Y |

# APPENDIX F. T&E DATABASE MANAGEMENT PROCESS

## 1. Purpose:

This document describes the process to be used for the storage, retrieval, and disposition of the data/information used by the T&E Joint Cross-Service Group (JCSG) and its Joint Working Group (JWG) for T&E cross-service analysis.

## 2. Scope:

The database is the repository for all working data/information used to conduct the T&E cross-service analysis and will consist of hard and soft copy information. Specifically, the database will serve as repository for working copies of the T&E data call responses; FYDP information; computed functional values, capacity, excess capacity, and workload; functional COBRA inputs and outputs; and optimization model inputs and outputs (See Atch 1). In addition, the database will maintain an audit trail for all data and model runs by the JWG. T&E JCSG approved data/information will be recorded in the official meeting minutes and stored by the OSD BRAC office.

A separate database will be established and maintained for classified data/information. Strict need to know rules will be applied to control access to this classified information.

## 3. Approach:

### 3.1 Inputs/Outputs:

The initial database inputs will be the certified responses from the data call and certified pertinent information from the FYDP. These initial data will be provided by the Military Departments and the OSD Comptroller.

Requisite data will be retrieved from the database to compute functional value, capacity, excess capacity, and workload. This computed information will also be stored in the database and provided to the Tri-Department BRAC Group as inputs to the optimization model. Results of the optimization runs will be stored in the database and used to develop realignment/consolidation alternatives. Functional COBRA runs will be conducted for the alternatives using data call responses and computed data extracted from the database. Results of functional COBRA runs will also be stored in the T&E database.

### 3.2 Configuration Control:

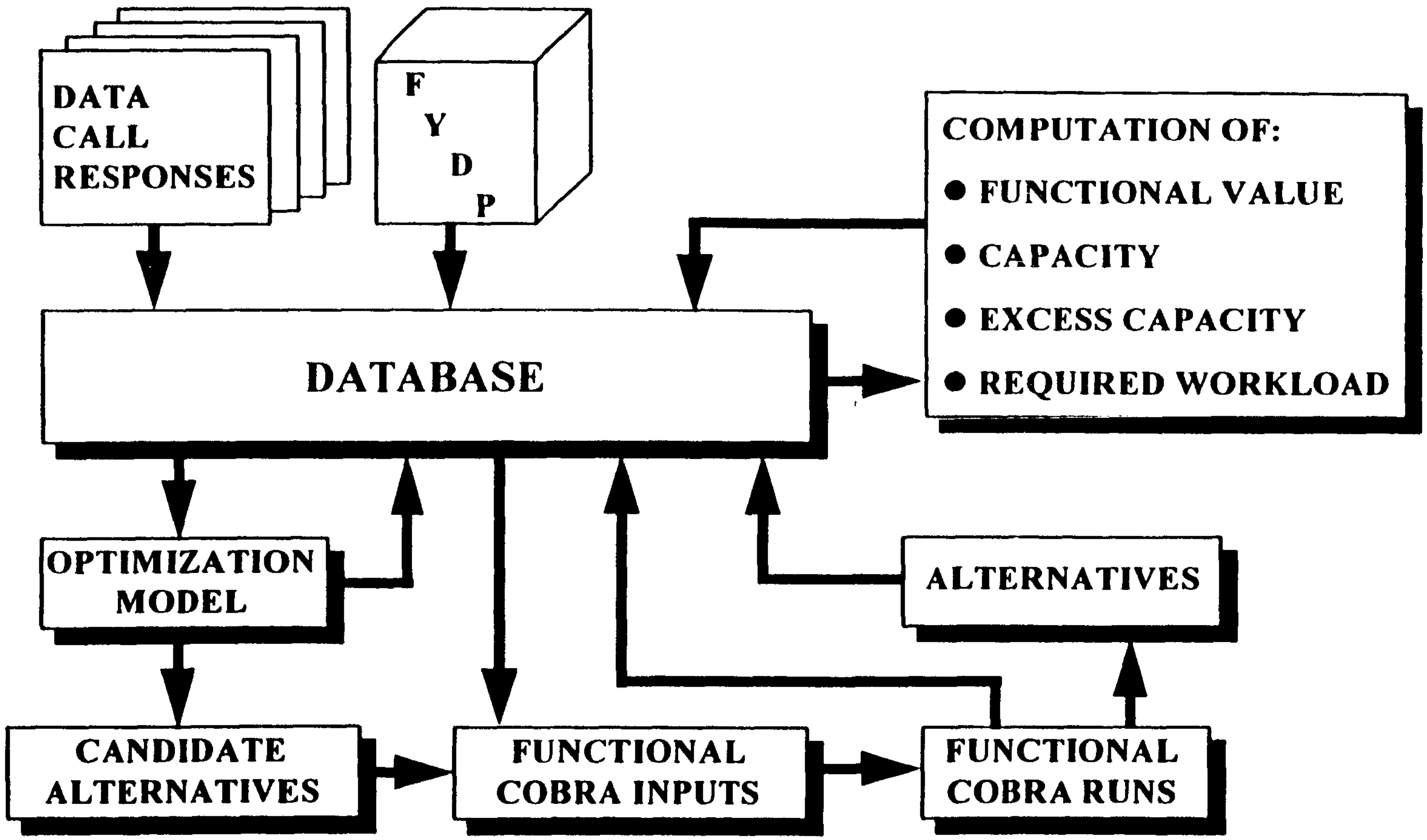
The data will be kept in a locked storage area with limited access. A data administrator will be appointed by the JCSG to ensure that data is properly controlled and maintained. The data administrator will keep track of revisions and maintain an audit trail on all changes to the database. The data administrator will serve as principal database interface with the Tri-Department BRAC Group and will maintain a log of control numbers for model runs.

## 4. Database Disposition at End of Study:

All the requisite database information will be submitted through the T&E JCSG to the OSD BRAC office for the record. This database information will include alternatives, input and output data, and other pertinent information. All working copies of the database and its supporting documentation will be destroyed.

Attachment 1

# DATABASE MANAGEMENT PROCESS



# APPENDIX G: CLASSIFIED DATA ANALYSIS

**1. INTRODUCTION:** This appendix provides the data analysis process used by the T&E Joint Cross-Service Group (T&E JCSG) to analyze classified data (as required) to supplement the overall data analysis process as described in the preceding sections of this Analysis Plan. This classified data analysis process provides a quantitative and defensible basis for incorporating classified data into the T&E functional value analysis and alternative evaluation process while requiring minimum exposure of sensitive information.

**2. DATA:**

a. Classified information used for workload and capacity analysis comes only from certified data received from the sites/activities in response to the official T&E JCSG Data Call of 31 Mar 94. Due to the classified nature of this data, it will be maintained by the Controlling Agent.

b. The Controlling Agent will arrange for appropriately cleared facilities for data review, when required. Only appropriately designated (in writing to the T&E JCSG Co-Chairs) and cleared BRAC team members will have access to the data, and the Controlling Agent will record to whom and when access was granted. At no time will classified data be removed from the Controlling Agent's control.

c. A minimum level of required information pertaining to the sites'/activities' workloads and capacities may be incorporated into other data for optimization runs and alternative development purposes. Classified material may be identified only in generic terms (e.g., as Site "A") and, of course, classified information cannot be included.

**3. SECURITY:**

a. Personnel in the following positions should be granted program access (assuming appropriate clearance levels):

1) One member from each Service to serve on the Analysis Team

2) The Lead Members from each Military Department on the T&E Joint Working Group

3) The principal OSD and Service members on the T&E JCSG

b. The names, ranks/grades, social security numbers, organizations, home stations, phone numbers, dates and places of birth, citizenship, and types and levels of clearances and security investigations for personnel serving in the above positions should be forwarded to the Controlling Agent not later than two weeks before access to classified data is required.

## Appendix C

## MAJOR COST DRIVERS

**Background**
While conducting COBRA evaluations of various options it becomes readily apparent that there are a few inputs that are major drivers towards the final costs. These major drivers constitute manpower eliminations, infrastructure construction or shutdown and continuing operating costs/savings with manpower elimination generally having the greatest impact. JCSG T&E certified data were evaluated to provide a comparison of the magnitude of these individual drivers for each Test Facility Category (TFC). The intent was to identify those TFC's that had the greatest potential savings and, considering the time limitations, concentrate realignment options within those areas of greatest potential. Through the use of the certified data, an evaluation was made of Facility Replacement Costs, Annual Maintenance Costs, and Total Personnel. This analysis provided a relative ranking of test facility categories (TFC) that provided the greatest potential for savings. The AEDC (Tullahoma) Measurement Facilities (MF) had a replacement value exceeding $6 Billion and were eliminated from the analysis. This replacement value was almost 4 times greater than the total of all other MF's remaining. The following analysis charts define the relative magnitude of the three areas evaluated across the six TFC's.

**Facility Replacement Costs**
Facility replacement costs were extracted from the T&E JCSG data inputs. The OAR results are influenced by the T&E JCSG data evaluation requirements which excluded support facilities and manning from the evaluation. While all TFC's have support requirements, the magnitude of the support is greatest for the OAR's. Most OAR's have a fleet of aircraft as well as an extensive support system in place to provide the data gathering and analysis requirements of the test. This would include, as an example, aircraft crews and maintenance support; Time-Space-Position Information (TSPI) radars, cameras and optics; telemetry support; communications support; mission scheduling and control; and data reduction and analysis as well as all the government and contractor supporting personnel. These omissions result in an understated picture of the true requirements for the OAR structure. It should be kept in mind that inclusion of the support facilities and personnel would significantly increase the Facility replacement cost as well as annual maintenance cost and total personnel associated with the OAR. The facility replacement cost analysis is presented in Figure 1.

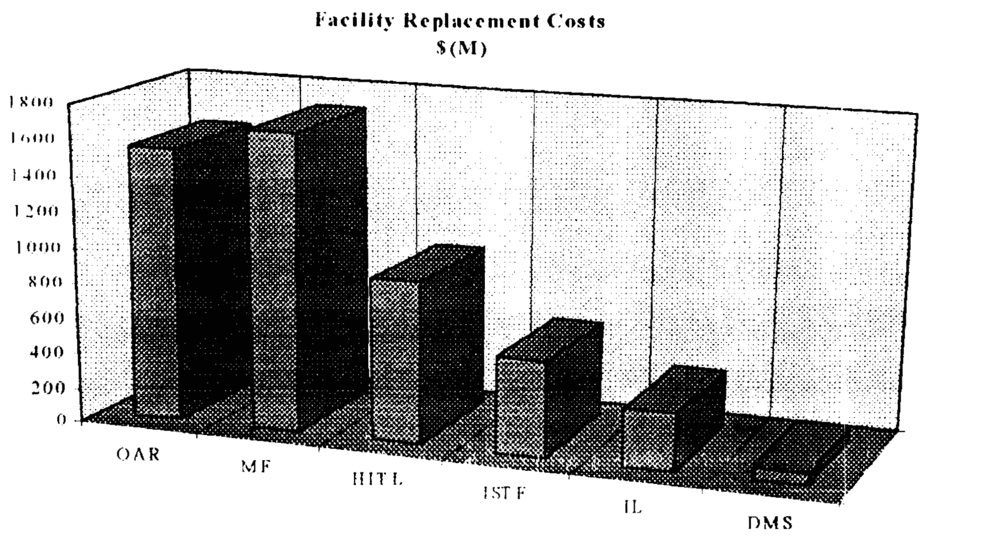



Figure 1

**Annual Maintenance Costs**

Annual maintenance costs were developed from the annual maintenance costs reported in the T&E JCSG. These costs were also influenced by the lack of support facility reporting as well as a possible lack of clear definition in the T&E JCSG data request. It was clear while gathering the data for this analysis that annual maintenance did not appear to be applied consistently across the services. An evaluation of annual maintenance costs is provided in Figure 2.

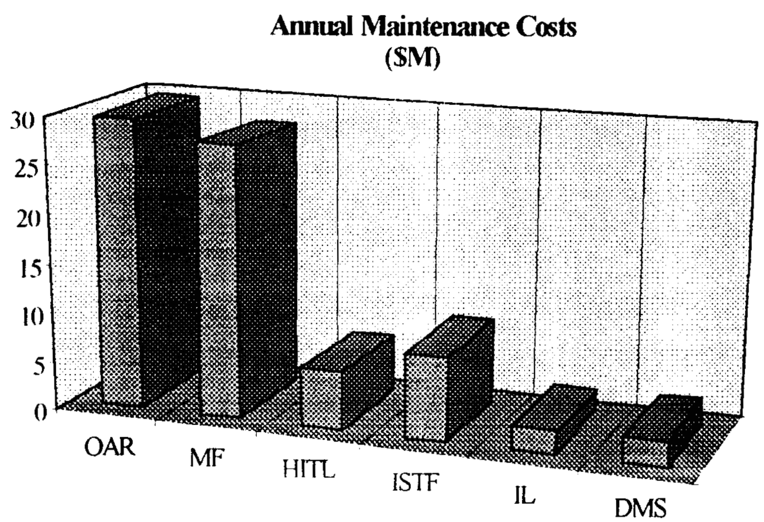



Figure 2

**Total Personnel**

The total personnel identified in the T&E JCSG data call against each facility are listed by TFC. No attempt was made to convert people to dollars since it was assumed that a portion of these personnel were already a part of the annual maintenance cost computations. As previously stated, the total personnel number is not all encompassing since it does not identify the personnel that are in support of all TFC's and that may comprise the majority of the OAR manning. Total personnel, as reported in the T&E JCSG data call, is provided in Figure 3.

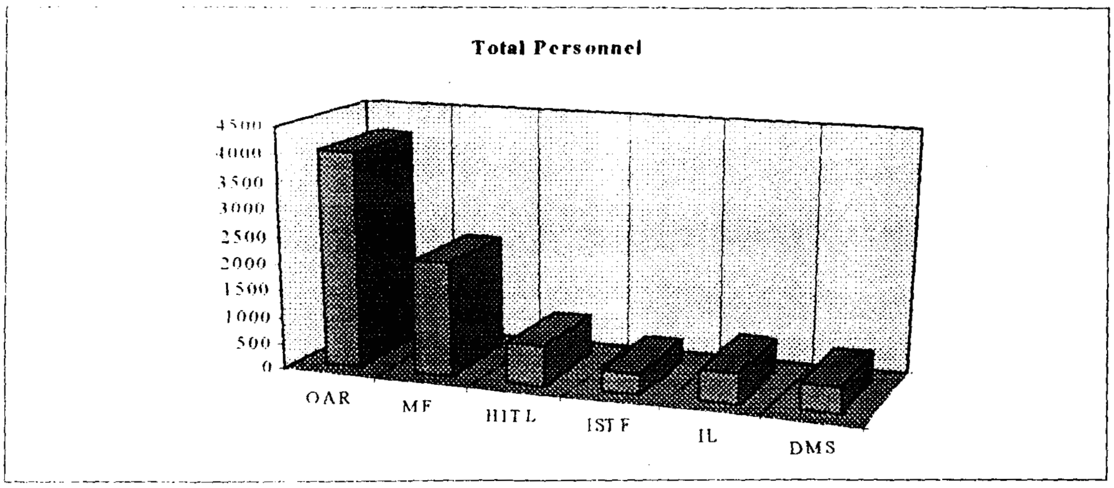
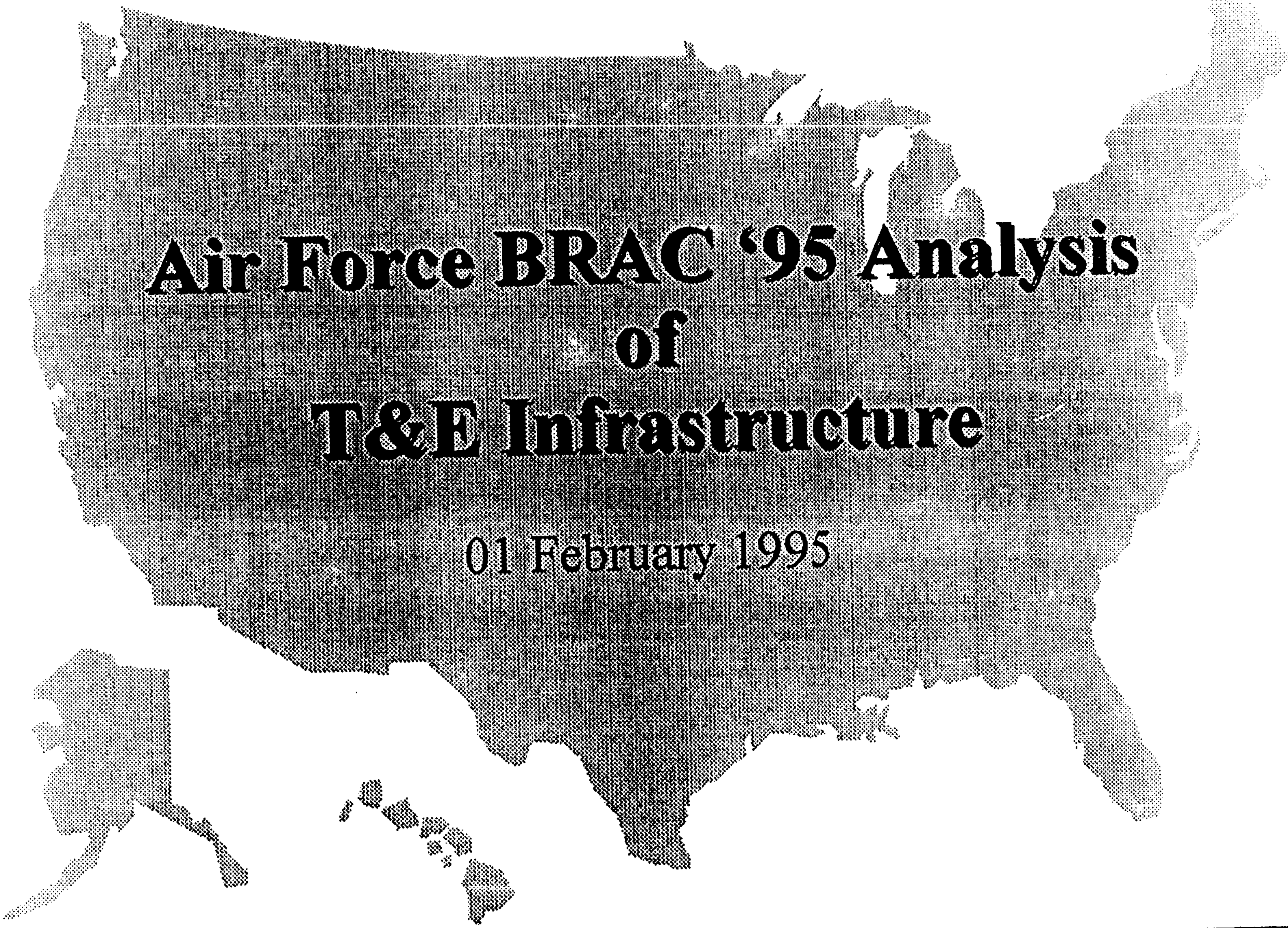



Figure 3

**Summary**

Based on the above, and with the knowledge that personnel elimination is the most significant driver, a rank order was developed to conform our greatest targets of opportunity. The results are presented by TFC in decreasing order of greatest potential for savings: Open Air Range (OAR), Measurement Facility (MF), Hardware-in-the-Loop (HITL), Installed Systems Test Facility (ISTF), Integration Laboratory (IL), and Digital Modeling and Simulation (DMS). While the relative ranking presented does not always follow the individual ranking for each cost area, it does reflect the overall analysis of the relative TFC rank. OAR and MF data are very close in several areas and the knowledge that there was a larger support requirement for the OAR's was a major factor in designating OAR's as the area of prime opportunity. Supporting this conclusion is the additional factor that there are nine fewer OAR's than MF's. Evaluation of averages by facility provided a further separation in the evaluation of the two TFC's.



# Air Force BRAC '95 Analysis of T&E Infrastructure

01 February 1995

# Purpose

- Present Results of AF Analysis of T&E Realignment & Consolidation Opportunities
  - Intra-AF
  - Cross-Servicing

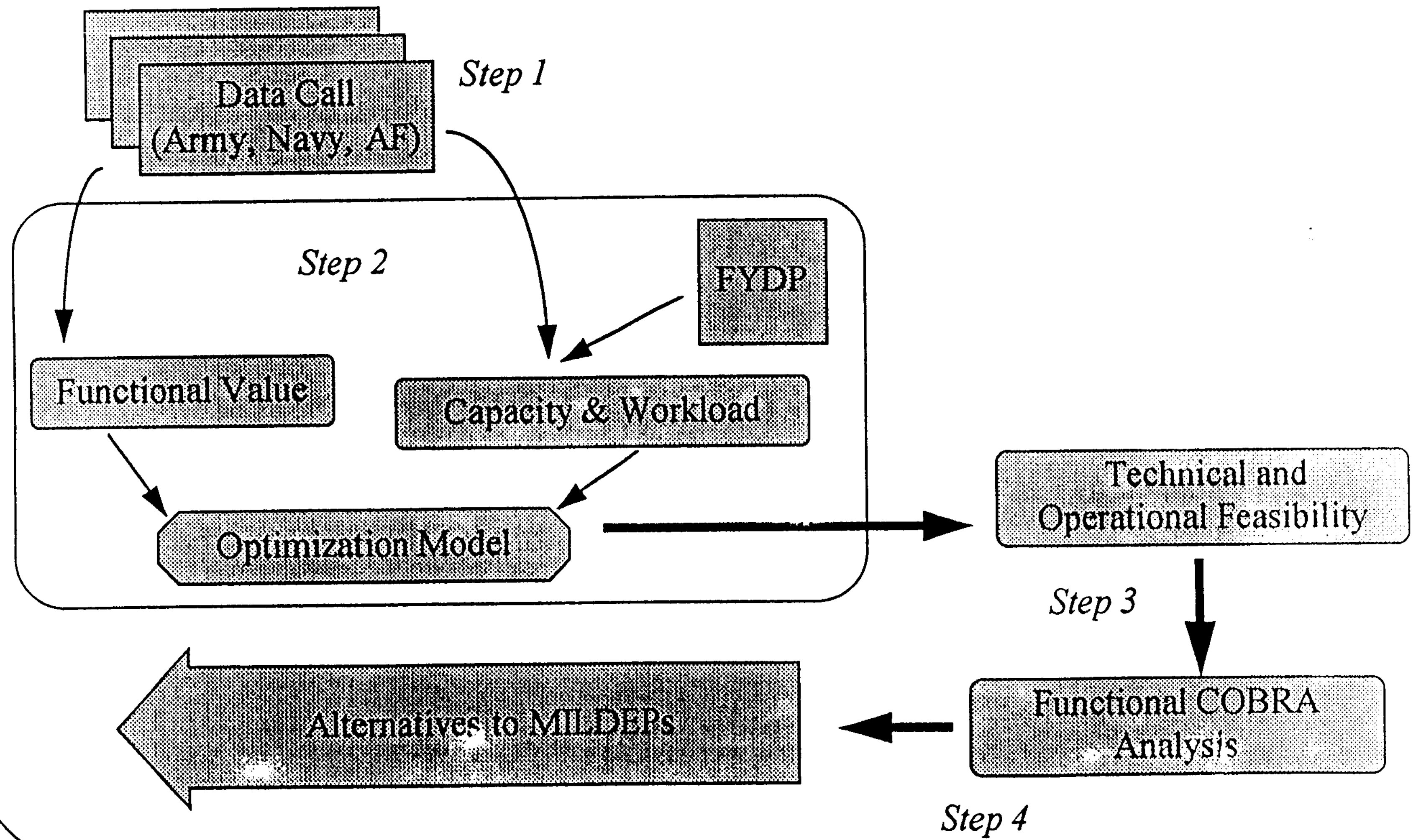
# Overview

- **Part I: Intra-AF T&E Realignments/Consolidations**
  - Basis for Response to T&E JCSG Alternatives
- **Part II: Completion of T&E JCSG Analysis Plan**
  - Addresses T&E Co-Chair Alternatives
- **Part III: Analysis of RDT&E Alternatives for Armament/Weapons, Explosives, and Propulsion**
  - Addresses Lab JCSG Chair's Alternatives

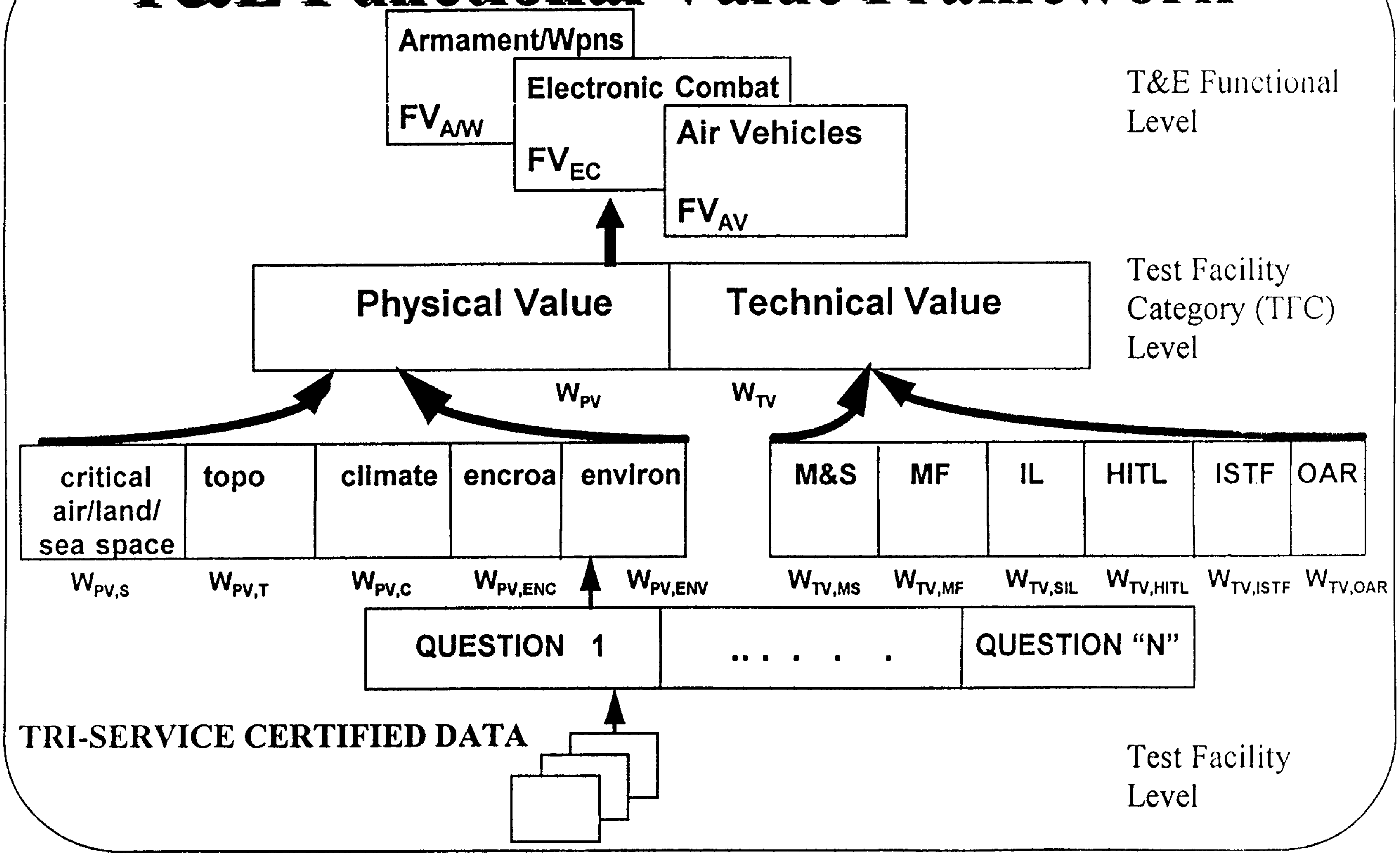
# Background

- T&E JCSG Analysis Plan Was Jointly Developed and Approved by BRAC '95 Steering Group
  - Air Vehicles, Air Armament/Weapons and Electronic Combat
  - Test Facility Level
  - Functional COBRA Costs
- T&E JCSG Did Not Complete Analysis IAW Approved Plan
  - "Activity" (e.g. AFFTC, Edwards AFB) versus Test Facility (e.g. ACETEF Facility at Pax River) Focus
    - AF/TE Nonconcurred
  - Activities Classified into "Core" and "Non-Core"
  - Realignments/Consolidations Between "Core" Activities Not Allowed
  - Steps 3 & 4 Deferred to MILDEPs

# T&E JCSG Analysis Framework



# T&E Functional Value Framework



# Core/Non-Core T&E Activities

## Summary

| MILDEP | Activity (Location) | Core | Non-Core | Retained by Opt Model | Retained as "Core" by T&E JCSG | Rationale |
|---|---|---|---|---|---|---|
| AF | AFFTC (Edwards) | √ | | | | |
| | AFDTC (Eglin) | √ | | | | |
| | AEDC (Arnold) | √ | | | | |
| | AFFTC (UTTR) | √ | | No | Yes | Cruise Missile Capability |
| | AFDTC (Holloman) | √ | | | | |
| | 475 WEG (Tyndall) | | √ | | | |
| | AFEWES (Ft Worth) | | √ | Yes | No | Not MRTFB OAR (PI 3c) |
| | REDCAP (Buffalo) | | √ | | | |
| Navy | NAWC (Pax River) | √ | | | | |
| | NAWC (China Lake) | √ | | | | |
| | NAWC (Pt Mugu) | √ | | | | |
| | NAWC (WSMR) | √ | | No | Yes | Unique Navy S-A Capability |
| | NAWC (Indianapolis) | | √ | | | |
| | NAWC (Warminster) | | √ | | | |
| | NSWC (Dahlgren) | | √ | Yes | No | Not MRTFB OAR (PI 3c) |
| | NSWC (Indian Head) | | √ | | | |
| | NSWC (Crane) | | √ | Yes | No | Not MRTFB OAR (PI 3c) |
| Army | WSMR | √ | | | | |
| | EPG | √ | | | | |
| | YPG | √ | | No | Yes | Unique Army Rotary Wing |
| | RTTC | | √ | | | |
| | ATTC - Ft Rucker | | √ | | | |
| | AQTD - Edwards | | √ | | | |

# Background (con't)

- T&E JCSG Co-Chairs Transmittal to MILDEPs Included Two Sets of Alternatives
  - Jointly Developed Alternatives, Supported By Joint Analysis, Addressing "Non-Core" Activities
  - Co-Chair Alternatives, With No Supporting Analysis, Addressing "Core" Activities
- Air Force Addressed Jointly Developed Alternatives In Its Intra-AF Analysis
  - Offered to Cross-Service Navy and Army in its Response
  - Did Not Respond to Co-Chair Alternatives Since No Supporting Analysis Provided

# Background (con't)

- Since T&E JCSG No Longer Active, AF Completed T&E JCSG Analysis Plan, Using Certified Data
  - Results Identify Specific Alternatives for "Core" Activities
  - Addresses Co-Chairs Concerns Regarding Excess Capacity Among "Core" Activities
- AF Combined Results of Above Analysis With Lab JCSG Results to Address Lab JCSG Chair's RDT&E Alternatives
  - Air-Launched Weapons, Propulsion, and Energetics

# Air Force BRAC '95 Analysis of T&E Infrastructure

## *Part I: Intra-AF Realignments/Consolidations

*Update of 12 Dec 94 Briefing for T&E JCSG Meeting, which was not held

# Purpose

- Present Results of Air Force Base Installation Analysis for T&E
  - Intra-AF T&E Realignments/Consolidations
  - Integration of T&E JCSG Alternatives
  - Basis for Response to T&E JCSG

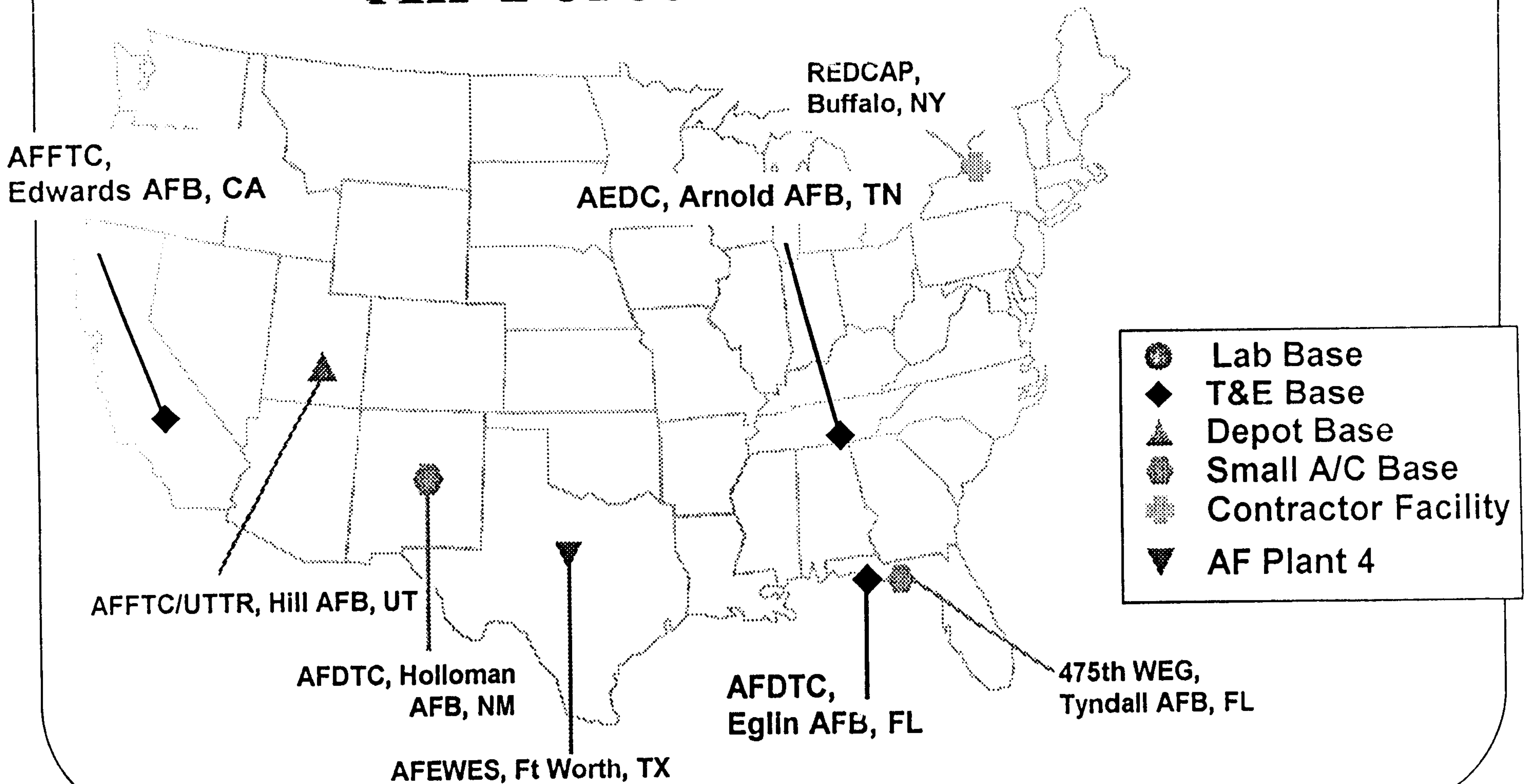
# Part I: Outline

- Scope
- Analysis Process
- Intra-AF Realignments
- JCSG Alternatives
- Summary

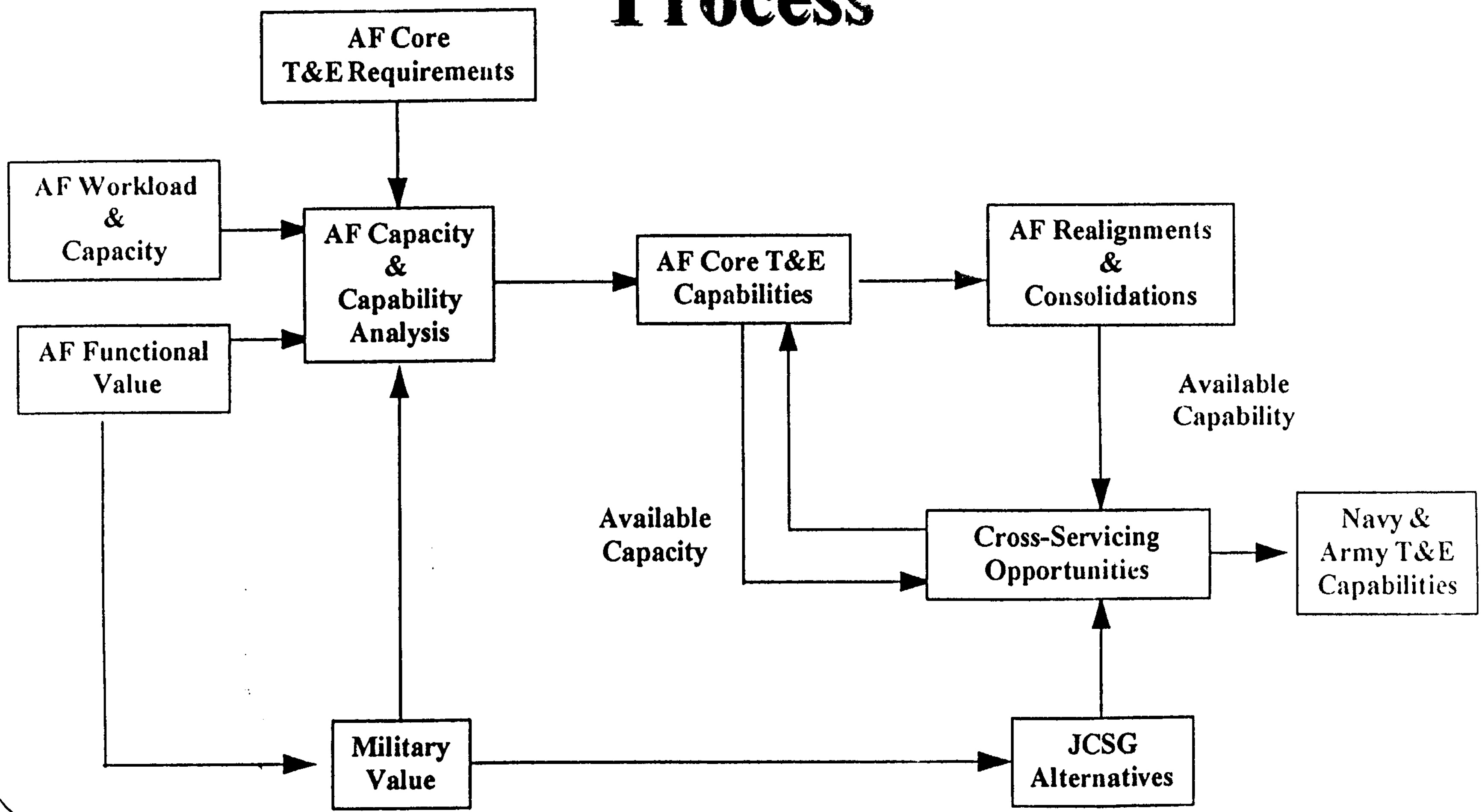
# Scope

- Focus of T&E JCSG Analysis on AF Primary Mission...Air Warfare
  - Air Vehicles
  - Air Armament/Weapons
  - Electronic Combat
- Other Services' Primary Missions Excluded
  - Navy: Surface and Subsurface Warfare
  - Army: Land Warfare

# Air Force T&E Locations



# AF T&E Analysis Process



# Capacity and Capability Analysis

## Capability Assessment

| T&E Function | AFFTC @ Edwards | AFFTC @ UTTR | AFDTC @ Eglin | AFDTC @ Holloman | 475 WEG @ Tyndall | AEDC @ Arnold | REDCAP @ Buffalo | AFEWES @ Ft Worth |
|---|---|---|---|---|---|---|---|---|
| Air Vehicle | F | | P | P | P | P | | |
| Armaments/ Weapons | | $\boxed{P}$ | F | P | P | P | | |
| Electronic Combat | $\boxed{P}$ | | $\boxed{P}$ | P | | | $\boxed{P}$ | $\boxed{P}$ |

**F** = Full Capability to Support All Six Test Facility Categories of the Acquisition/Test Process

**P** = Partial Capability

□ = Intra-AF Realignment/Consolidation Opportunities

◯ = Geographically Constrained or Not Cost Effective to Move

# AF Realignments & Consolidations
## Intra-AF Candidates

- Air Vehicle
  - None
- Armaments/Weapons
  - AFFTC (UTTR) Capabilities
- Electronic Combat
  - REDCAP (Buffalo) and AFEWES (Ft Worth) Hardware-in-the-Loop Facilities/Workload
  - AFDTC/EMTE (Eglin) Open-Air Range Facilities/Workload

# Armament/Weapons Realignment
## AFFTC (UTTR)

- Realign UTTR from AFMC T&E Range to ACC Training Range
  - Retain Minimum Capability to Support Training Requirements and Large Footprint Weapons T&E (e.g., Cruise Missile)
    - Critical Air/Land Space
    - MobileT&E Instrumentation/Support
  - Transfer Workload to AFDTC (Eglin) and AFFTC (Edwards)
  - Downsize Personnel to Satisfy New Requirements
  - Dispose of Remaining Equipment/Instrumentation
- Rationale
  - 82% of Current Missions are Training (Only 18% T&E)
  - Most of Current T&E Can Be Accomplished With Existing Core T&E Capabilities (AFDTC and AFFTC)
  - Requirement to Retain Air/Land Space

# Criteria IV & V

## AFFTC (UTTR) Realignment

| 1-Time Cost | 20 YR NPV* | Steady State Savings | ROI (Years) | Gov't Pers Savings |
|---|---|---|---|---|
| $3.2M | ($179.9M) | $12.4M | 0 | 104 |

* ( ) Indicate Savings

# Electronic Combat (EC) Realignment
# REDCAP/AFEWES/AFDTC (EMTE)

- Realign REDCAP &AFEWES Hardware-In-The-Loop (HITL) and AFDTC/EMTE Open-Air-Range (OAR) Facilities
  - Move Workload and Required Equipment from REDCAP and AFEWES to AFFTC/BAF (Edwards) and AFDTC/GWEF (Eglin) Facilities
  - Move Required Threat Systems from AFDTC/EMTE (Eglin) to Nellis Complex
  - Disestablish REDCAP, AFEWES, and Dispose of Remaining Equipment
  - Retain Threat Emitters at AFDTC (Eglin) to Support AFSOC, AWC, and Armaments/Weapons T&E
- Rationale
  - 1) * Projected Workload/Requirement at REDCAP and AFEWES is 10% and 28% of their Respective Capacities
  - AF EC OAR Workload/Requirement Can Be Satisfied with One versus Two Ranges
  - Available Capacity at Existing Core AF T&E Activities to Absorb Workload

# Criteria IV & V

## REDCAP/AFEWES/AFDTC (EMTE) Realignment

| | 1-Time Cost | 20 YR NPV* | Steady State Savings | ROI (Years) | Gov't Pers Savings |
|---|---|---|---|---|---|
| REDCAP | $1.7M | ($11.0M) | $0.9M | 1 yr | 2 |
| AFEWES | $5.8M | ($5.8M) | $0.8M | 7 yrs | 3 |
| EMTE | $2.2M | ($31.4M) | $2.6M | 1 yr | 0 |

* ( ) Indicate Savings

# T&E JCSG Alternatives

## Overview

- 13 Alternatives (14 Realignment Opportunities) Jointly Developed by T&E JCSG Evaluated by AF
  - 6 Air Vehicle
  - 5 Armament/Weapons
  - 3 Electronic Combat
- AF Activities Scored Highest Functional Value in Each T&E Functional Area
  - Selected as Preferred Receiver by Optimization Model

# T&E JCSG Alternatives

## Functional Values

### Air Vehicles

| Activity | JCSG FV |
|---|---|
| AFFTC- Edwards | 85 |
| NAWC - Pax River | 81 |
| NAWC - Pt Mugu | 69 |
| AFDTC - Eglin | 56 |
| 476WEG - Tyndall | 49 |
| UTTR - Hill | 46 |
| AQTD - Edwards | 46 |
| EPG - Ft Huachuca | 44 |
| NAWC - China Lake | 43 |
| YPG - Yuma | 35 |
| ATTC - Ft Rucker | 34 |
| AFDTC - Holloman | 33 |
| NSWC - Dahlgren | 25 |
| NAWC - Indianapolis | 19 |
| AEDC - Arnold | 18 |
| NAWC - Warminster | 14 |

### Armaments/Weapons

| Activity | JCSG FV |
|---|---|
| AFDTC - Eglin | 82 |
| NAWC - Pt Mugu | 77 |
| NAWC - Pax River | 57 |
| NAWC - China Lake | 57 |
| WSMR | 50 |
| AFDTC - Holloman | 30 |
| YPG - Yuma | 29 |
| NAWC - WSMR | 25 |
| RTTC - Redstone | 21 |
| NSWC - Dahlgren | 17 |
| AEDC - Arnold | 16 |
| NSWC - Indian Head | 14 |
| NSWC - Crane | 13 |

### Electronic Combat

| Activity | JCSG FV |
|---|---|
| AFDTC - Eglin | 65 |
| NAWC - Pt Mugu | 58 |
| NAWC - Pax River | 53 |
| AFFTC- Edwards | 52 |
| NAWC - China Lake | 47 |
| EPG - Ft Huachuca | 47 |
| AFDTC - Holloman | 29 |
| NSWC - Crane | 17 |
| AFEWES - Ft Worth | 17 |
| REDCAP - Buffalo | 15 |

# T&E JCSG Alternatives
## Air Vehicle

| T&E JCSG Alternative | Realignment Opportunity | Capability/ Capacity Fit | Recommendation |
|---|---|---|---|
| TE-1 (AV) | Ft Rucker Rotary Wing | Yes | Cross-Service Army at Edwards |
| TE-2 (AV) | AQTD Edwards Rotary Wing | Yes | Retain at Edwards |
| TE-3 (AV) | Indianapolis Measurement/Integration | No | Do Not Cross-Service |
| TE-4 (AV) | Dahlgren Measurements | No | (No AF Involvement) |
| TE-5 (AV) | Warminster Digital Sims | No | (No AF Involvement) |
| TE-6 (AV) | Tyndall Radar Test Facility | Partial | Intra-AF Realignment |

# T&E JCSG
# Alternatives
## Armaments/Weapons

| T&E JCSG Alternative | Realignment Opportunity | Capability/ Capacity Fit | Recommendation |
|---|---|---|---|
| TE-1 (AW) | Crane Ordance Measurements | Yes | Cross-Service Navy at Eglin |
| TE-2 (AW) | Dahlgren Ordance Measurements | Yes | Cross-Service Navy at Eglin |
| TE-3 (AW) | Indian Head Propulsion | Partial | Do Not Cross-Service Navy |
| TE-4 (AW) | Redstone Open Air Range | Yes | Cross-Service Army at Eglin |
| | Redstone Component Testing | Partial | Do Not Cross-Service Army |

# T&E JCSG
# Alternatives
## Electronic Combat

| | T&E JCSG Alternative | Realignment Opportunity | Capability/ Capacity Fit | Recommendation |
|---|---|---|---|---|
| * | TE-1 (EC) | REDCAP, Buffalo NY | Partial | Intra-AF Realignment |
| * | TE-2 (EC) | AFEWES, Ft Worth TX | Partial | Intra-AF Realignment |
| | TE-3 (EC) | Crane Electromagnetics | No | (No AF Involvement) |

* "Requests for Data" Also Sent to the Navy

# T&E JCSG Alternatives

## Recap

- 14 Realignment Opportunities
  - 11 Identify AF As Potential Receiver
  - 3 Do Not Involve AF
- For 11 Realignments with AF As Potential Receiver
  - 3 Recommended for Intra-AF Realignments
    - 2 Evaluated for Cross-Servicing (w/Navy)
  - 5 Recommended for AF to Cross-Service
    - Capacity/Capability Fit (Beneficial to AF/DoD)
  - 3 Not Recommended for AF to Cross-Service
    - Partial to No Capability Fit (No Benefit to AF/DoD)
- Above Consistent with AF Core T&E Capabilities
  - Appear to have no TOA or End Strength Implications

# T&E JCSG Alternatives

## Status

- AF (as Losing Service) Issued "Requests for Data" for TE-1 (EC)/REDCAP and TE-2 (EC)/AFEWES to Navy and Evaluated Response (Not Cost-Effective)
  - No Request Made for TE-6 (AV)/Tyndall Radar Test Facility Since Predominantly AF Unique to F-15 & F-16
- Army Has Requested Data for All 4 of its T&E JCSG Alternatives (As Losing Service)
  - AF has Responded and Offered to Cross-Service 3 of 4 Opportunities Within Available AF Capability/Capacity
- Navy Has Not Requested Data for Any of its 7 T&E JCSG Alternatives to Date (As Losing Service)

# Criteria IV & V

## Evaluation of TE-1 (EC)/REDCAP & TE-2 (EC)/AFEWES

| T&E JCSG Alternative | Potential Receiver Sites | 1-Time Cost ($M) | 20 YR NPV* ($M) | Steady State Savings ($M) | ROI (Years) | Gov't Pers Savings |
|---|---|---|---|---|---|---|
| TE-1 (EC)/REDCAP | | | | | | |
| | ** EDWARDS | 1.7 | (11.0) | 0.9 | 1 | 2 |
| | PAX | 3.9 | (7.3) | 0.8 | 4 | 0 |
| | PT MUGU | 4.8 | 2.7 | (0.1) | 100+ | 2 |
| TE-2 (EC)/AFEWES | | | | | | |
| | ** EDWARDS | 5.8 | (5.8) | 0.8 | 7 | 3 |
| | PAX | 6.1 | (0.9) | 0.5 | 14 | 0 |
| | PT MUGU | 10.7 | 6.5 | 0.3 | 100+ | 2 |

** Most Cost-Effective Option
* ( ) Indicate Savings

# Part I: Summary

- AF Core T&E Capabilities/Workload to Support AF Mission Already Consolidated for Air Vehicles (AFFTC, Edwards AFB) and Armaments/Weapons (AFDTC, Eglin AFB) to Extent Possible with Few Exceptions
  - Exceptions Addressed in Intra-AF Realignments
- AF Core T&E Capability/Workload for Electronic Combat Fragmented
  - Consolidation to Minimum Number of Activities/Sites Addressed in Intra-AF Realignments
  - Two T&E JCSG Cross-Servicing Opportunities Evaluated with Navy (i.e. REDCAP and AFEWES), But Not Cost-Effective
- Signficant Opportunities for Intra-Service Consolidation Exists Within Navy and Army
  - Presumably Will Be Addressed in their Intra-Service Analyses

# Tri-Service T&E Activities

| T&E Functional Area | AF* | Navy | Army |
|---|---|---|---|
| AV | AFFTC, Edwards | NAWC, Pax River<br>NAWC, Pt Mugu<br>NAWC, Indianapolis<br>NAWC, China Lake<br>NAWC, Dahlgren<br>NAWC, Warminster | Yuma Proving Grounds<br>ATTC, Ft Rucker<br>AQTD, Edwards<br>EPG, Ft Huachuca |
| A/W | AFDTC, Eglin | NAWC, Pax River<br>NAWC-WD, China Lake<br>NAWC-WD, Pt Mugu<br>NAWC, WSMR<br>NSWC, Crane<br>NSWC, Dahlgren<br>NSWC, Indian Head | WSMR<br>YPG<br>RTTC, Redstone |
| EC | AFFTC, Edwards<br>Nellis Complex | NAWC-WD, China Lake<br>NAWC-AD, Pax River<br>NSWC, Crane<br>NAWC, Indianapolis<br>NAWC, Pt Mugu | WSMR<br>EPG, Ft Huachuca |
| DoD/ National Facilities | AEDC, Arnold<br>AFDTC, Holloman | | |

* After Intra-AF Realignments

# Part I: Summary (cont'd)

- T&E JCSG Alternatives Integrated Into AF Analysis and Opportunities for Cross-Servicing Being Evaluated
  - 2 Requests to Navy to Cross-Service AF
  - 3 Offers By AF to Cross-Service Army
  - No Requests from Navy to Cross-Service
- Intra-AF Consolidations of Core T&E Capabilities Eliminates All Excess Capacity Linked to Infrastructure Savings
  - Remaining Excess Represents "Sunk Costs" and Is Capacity Available for Future Workload/Surge and Cross-Servicing
- AF Already Providing Significant Cross-Servicing Using AF Core T&E Capabilities
  - AFFTC (Edwards AFB)
  - AFDTC (Eglin AFB)
  - AEDC (Arnold AFB)

# AF Current Cross-Servicing

- AFFTC (Edwards AFB CA)
  - Army's Rotary Wing AQTD at Edwards
  - NASA Flight Operations
  - Space Shuttle
- AFDTC (Eglin AFB FL)
  - Army's Hellfire Test Complex
  - Joint AF/Army Munitions T&E ("Chicken Little")
- AFDTC (Holloman AFB NM)
  - Central Inertial Guidance Test Facility (CIGTF)
  - High Speed Test Track (HSTT)
  - Flight Operations and Full Scale Aerial Target Support for Army's WSMR
- AEDC (Arnold AFB TN)
  - Wind Tunnels and Propulsion Facilities

# Air Force BRAC '95 Analysis of T&E Infrastructure

Part II: Completion of JCSG Analysis Plan

# Purpose

- Present Results of AF Analysis Based on Completion of T&E JCSG Analysis Plan
  - Identify Cross Servicing Opportunities Between T&E "Core" Activities for Each T&E Functional Area
  - Address T&E Co-Chairs Alternatives

# T&E Functional Analysis/Results Overview

**T&E Functional Area Baseline**
- Activities
- FV & MV
- Workload & Capacity

**Optimization Model Outputs**
- MAXSFV (MINSITES) Soln
- Workload Assignments by Activity/TFC

**Capacity/Capability Analysis**
- Mismatches
- Test Facility Level
- Across TFCs and T&E Functional Areas

Adjust opt Model Outputs

**Potential Realignment Opportunities**
- OAR
- Ground Facilities
- Order of Greatest Potential Savings

**DoD T&E Requirements Analysis**
- Natural & Technical Resources
- Policy Imperatives

**Primary Alternatives**
- OAR
- Other

**Functional COBRA Run (To Extent Possible)**
- Scenario Description
- ROM Cost/Savings

**Recommended Alternatives**
- Potential Reductions in Number of Activities/Facilities and Excess Capacity
- Estimated Cost/Savings
- Potential Impacts

# EC T&E Baseline
## DoD Workload (Test Hours)

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| AFDTC Eglin | 65 | | 2390 | | | 761 | 899 |
| NAWC Pt Mugu | 58 | | 487 | 459 | 223 | | |
| NAWC Pax River | 53 | | 148 | | | 2843 | |
| AFFTC Edwards | 52 | | | 3088 | | | 758 |
| NAWC China Lake | 47 | | 2311 | 1770 | | | 745 |
| EPG | 47 | 246 | 858 | | | | 369 |
| AFDTC Holloman | 29 | | 6091 | | | | |
| AFDTC AFEWES | 17 | | | | 2524 | | |
| NSWC Crane | 17 | | 4344 | | | | |
| AFDTC REDCAP | 15 | | | | 86 | | |

# Optimization Model Output (Test Hours)
## Electronic Combat

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| **AFDTC, Eglin AFB** | **65** | | **2902** | | | 2202 | 1978 |
| **NAWC, Pt Mugu** | **58** | | **98** | **850** | **420** | | |
| **NAWC, Pax River** | **53** | | **0** | | | 1402 | |
| **AFFTC, Edwards AFB** | **52** | | | **4467** | | | 112 |
| **NAWC, China Lake** | **47** | | **0** | **0** | | | 0 |
| **EPG** | **47** | **246** | **1924** | | | | 0 |
| **AFDTC, Holloman** | **29** | | **8402** | | | | |
| AFDTC, AFEWES | 17 | | | | 2413 | | |
| NSWC, Crane | 17 | | 3303 | | | | |
| AFDTC, REDCAP | 15 | | | | 0 | | |

# Part II: Outline

- Background
- T&E JCSG Analysis Process
- T&E Functional Analysis/Results
  - Electronic Combat
  - Air Vehicle
  - Armament/Weapons
- T&E JCSG Co-Chair Alternatives
- Cost Analysis
- Summary



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# Capability/Capacity Analysis for EC T&E
## Open Air Ranges

Mismatches: Nellis Range Complex, Eglin and China Lake Have Comparable Capabilities; Edwards Has No Threat Simulators, and EPG is Primarily a C³ Test Capability

| Before: | After: |
|---|---|
| 1 Facility at Eglin | 1 Facility at Eglin |
| 1 Facility at China Lake | Nellis Range Complex |
| 1 Facility at Edwards | 1 Facility at Edwards |
| 1 Facility at EPG | 1 Facility at EPG |

| Before | After |
|---|---|
| 4 Facilities | 3 Facilities |
| 4 Activities | 3 Activities |
| Capacity = 5860 Test Hours | Capacity = 4039 Test Hours |
| Excess Capacity = 3089 Test Hours | Excess Capacity = 1268 Test Hours |


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## Capability/Capacity Analysis for Electronic Combat T&E
## Adjusted Optimization Model Workload (Test Hours)

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| **AFDTC, Eglin AFB** | **65** | | **3000** | | | **761** | **963** |
| **NAWC, Pt Mugu** | **58** | | **0** | **0** | **0** | | |
| **NAWC, Pax River** | **53** | | **0** | | | **6369** | |
| **AFFTC, Edwards AFB** | **52** | | | **3088** | | **2610** | **1127** |
| **NAWC, China Lake** | **47** | | **0** | **2229** | | | **0** |
| **EPG** | **47** | **246** | **1924** | | | | **0** |
| **AFDTC, Holloman** | **29** | | **8402** | | | | |
| AFDTC, AFEWES | 17 | | | | 0 | | |
| NSWC, Crane | 17 | | 0 | | | | |
| AFDTC, REDCAP | 15 | | | | 0 | | |

# EC T&E
# Potential Realignment Opportunities

- Non-Core (JCSG) Alternatives
  - TE-1 (EC): Realign HITL at AFDTC Buffalo (REDCAP)
  - TE-2 (EC): Realign HITL at AFDTC Ft Worth (AFEWES)
  - TE-3 (EC): Realign EM Effects MF at NSWC Crane
- Core
  - Core-1 (EC): Realign NAWC China Lake OAR to Nellis Range Complex and AFDTC Eglin
  - Core-2 (EC): Realign NAWC China Lake RCS MF to AFDTC Holloman
- Additional Core
  - Realign Signature MF from NAWC Pt Mugu to AFDTC Eglin
  - Realign Communications MF from NAWC Pax River to EPG
  - Realign IL from NAWC Pt Mugu to NAWC China Lake
  - Realign HITL from NAWC Pt Mugu to ISTF at NAWC Pax River
  - Realign OAR from EPG to AFFTC Edwards

# Optimization Model Output
# Armament/Weapons Workload (Test Hours)
## MAXSFV (MINSITES)

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| **AFDTC Eglin** | **82** | **55,305** | **29,523** | | **18,611** | **443** | 16,036 |
| **NAWC Pt Mugu** | **77** | **0** | **59,481** | **11,916** | **34,056** | | 11,609 |
| **NAWC China Lake** | **57** | **0** | **24,782** | **1,452** | **0** | | 3,986 |
| **NAWC Pax River** | **57** | | | | | 349 | |
| **WSMR** | **50** | | 396 | | | | 111 |
| **AFDTC Holloman** | **30** | | **11,221** | | | | |
| **YPG** | **29** | | **0** | | | | 0 |
| **NAWC WSMR** | **25** | | | | | | 0 |
| RTTC | 21 | | 0 | | | | 0 |
| NSWC Dahlgren | 17 | | 0 | | | | |
| **AEDC Arnold** | **16** | | **755** | | | | |
| NSWC Indian Head | 14 | | 0 | | | | |
| NSWC Crane | 13 | | 0 | | | | |

**Capability/Capacity Analysis for Armament/Weapons T&E**

# Adjusted Optimization Model Workload (Test Hours)

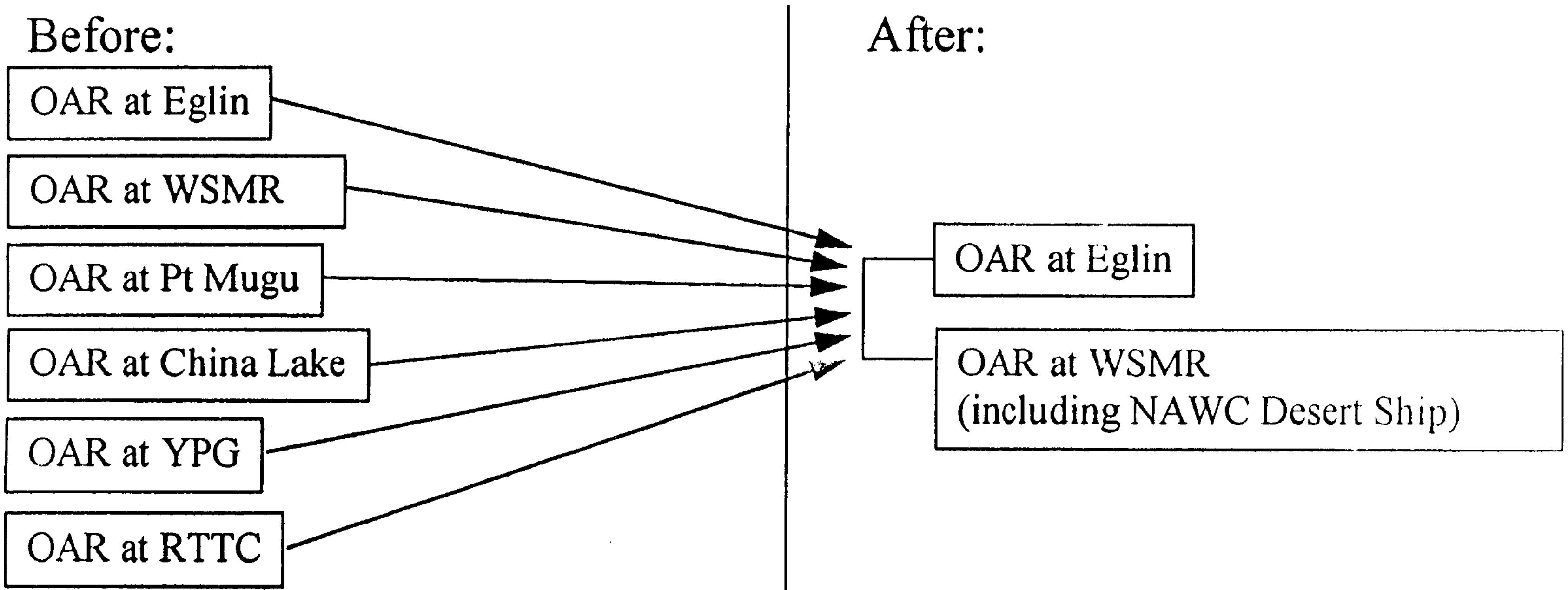
| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| **AFDTC Eglin** | **82** | **55,305** | **28,736** | | 16,667 | 792 | 16,036 |
| **NAWC Pt Mugu** | **77** | **0** | **39,010** | **0** | (1) **0** | | 0 |
| **NAWC China Lake** | **57** | **0** | **13,609** | **13,368** | **0** | | 0 |
| **NAWC Pax River** | **57** | | | | | **0** | |
| **WSMR** | **50** | | **20,278** | | | | (2) 7,298 |
| **AFDTC Holloman** | **30** | | **21,812** | | | | |
| **YPG** | **29** | | **0** | | | | 0 |
| **NAWC WSMR** | **25** | | | | | | 1,791 |
| RTTC | 21 | | 0 | | | | 0 |
| NSWC Dahlgren | 17 | | 0 | | | | |
| **AEDC Arnold** | **16** | | **2,107** | | | | |
| NSWC Indian Head | 14 | | 0 | | | | |
| NSWC Crane | 13 | | 0 | | | | |

Note: (1) Plus 36,000 Test Hours (DM&S, MF, IL Combination)
(2) Plus 6,246 Test Hours (DM&S, MF, IL Combination)

**Capability/Capacity Analysis for Armament/Weapons T&E**

# Open Air Range (cont'd)

Mismatches:
(1) Long Range, Over Land Test Hours at WSMR
(2) WSMR Warhead Test Hours are MF vice OAR
(3) WSMR Material Test Facility Mixture of TFC Hours (DM&S,MF, IL Testing vice OAR)




Before:
6 Ranges (12 Facilities)
7 Activities (Including NAWC Desert Ship)
Capacity = 56347 Test Hours
Excess Capacity = 31222 Test Hours

After:
2 Ranges (6 Facilities)
3 Activities
Capacity = 35567 Test Hours
Excess Capacity = 10442 Test Hours

# Armament/Weapons T&E Baseline
# DoD Workload (Test Hours)

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| AFDTC Eglin | 82 | 39,324 | 13,144 | | 12,085 | 168 | 7,598 |
| NAWC Pt Mugu | 77 | 3,916 | 18,275 | 5,774 | 39,225 | | 4,068 |
| NAWC China Lake | 57 | 12,065 | 45,387 | 7,594 | 1,357 | | 2,169 |
| NAWC Pax River | 57 | | | | | 624 | |
| WSMR | 50 | | 7,608 | | | | 13,275 |
| AFDTC Holloman | 30 | | 5,129 | | | | |
| YPG | 29 | | 127 | | | | 2,055 |
| NAWC WSMR | 25 | | | | | | 1,791 |
| RTTC | 21 | | 30,089 | | | | 786 |
| NSWC Dahlgren | 17 | | 954 | | | | |
| AEDC Arnold | 16 | | 2,107 | | | | |
| NSWC Indian Head | 14 | | 2,196 | | | | |
| NSWC Crane | 13 | | 1,142 | | | | |

# Recap
# Electronic Combat T&E

| Option | Activities | Facilities | DoD Capacity (Test Hours) | DoD Excess Capacity (Test Hours) | Comments |
|---|---|---|---|---|---|
| Baseline | 10 | 24 | 64909 | 33501 | |
| Non-Core (JCSG) Alternatives | 7 <30%> | 22 <8%> | 52284 <19%> | 21244 <36%> | Non-Core Realigned |
| Core-1 (EC) (OAR) | 7 <30%> | 21 <12%> | 50463 <22%> | 19744 <40%> | Non-Core Realigned Plus OAR Consolidation |
| Core-2 (EC) (RCS MF) | 7 <30%> | 20 <17%> | 46980 <28%> | 16261 <51%> | Non-Core Realigned Plus OAR & RCS MF Consolidation |
| Add'l Alternatives * | 6 <40%> | 14 <42%> | 43389 <33%> | 12670 <62%> | Core and Non-Core Realigned |

* Maximum Reductions Achievable

<> = % Reduction

# Armament/Weapons T&E Potential Realignment Opportunities

- Non-Core (JCSG) Alternatives
  - TE-1 (A/W): MF Workload from NSWC Crane
  - TE-2 (A/W): MF Workload from NSWC Dahlgren
  - TE-3 (A/W): MF Workload from NSWC Indian Head
  - TE-4 (A/W): MF and OAR Workload from RTTC
- Core Alternatives
  - Core-1 (AW): OAR Workload from NAWC Pt Mugu, China Lake, and YPG to AFDTC Eglin and WSMR
- Additional Core
  - Realign Ground Facilities
    - Impacts Navy and Army Weapons R&D, Surface-to-Surface T&E, etc.

# Recap
# Armament/Weapons T&E

| Options | Activities | Facilities | DoD Capacity (Test Hours) | DoD Excess Capacity (Test Hours) | Comments |
|---|---|---|---|---|---|
| Baseline (Adjusted) | 13 | 79 | 549,291 | 270,236 | |
| Non-Core (JCSG) Alternatives | 9 <31%> | 68 <14%> | 495,823 <10%> | 216,768 <20%> | Non-Core Realigned |
| Core-1 (A/W) OAR Realignment | 9 <31%> | 62 <22%> | 476,231 <13%> | 197,176 <27%> | Non-Core Realigned Plus MRTFB OAR Consolidation |
| Add'l Core Ground Facility Realignment * | 6 <54%> | 37 <53%> | 359,594 <35%> | 80,539 <70%> | Core and Non-Core Realigned |

* Maximum Reductions Achievable

<> = % Reduction

# Air Vehicles T&E Baseline
## DoD Workload (Test Hours)

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| AFFTC, Edwards | 85 | 270 | 2360 | 69485 | | 121 | 7583 |
| NAWC, Pax River | 81 | | 27288 | 2275 | 112239 | 9553 | 7661 |
| NAWC, Pt Mugu | 69 | | 327 | | | | 1679 |
| AFDTC, Eglin | 58 | | 4911 | | | | |
| 476 WEG, Tyndall | 47 | | | | 1932 | | |
| UTTR, Hill | 46 | | | | | | 1940 |
| AQTD, Edwards | 46 | | | | | | 1258 |
| EPG, Ft Huachuca | 44 | | 398 | | | | 277 |
| NAWC, China Lake | 43 | | 1830 | | | | |
| YPG, Yuma | 35 | | 131 | | | | 3404 |
| ATTC, Ft Rucker | 34 | | | | | | 3776 |
| AFDTC, Holloman | 33 | | 27530 | | | | |
| NSWC, Dahlgren | 25 | | 943 | | | | |
| NAWC, Indianapolis | 19 | | 16324 | 10046 | | | |
| AEDC, Arnold | 18 | | 2569 | | | | |
| NAWC, Warminster | 14 | 1003 | | | | | |

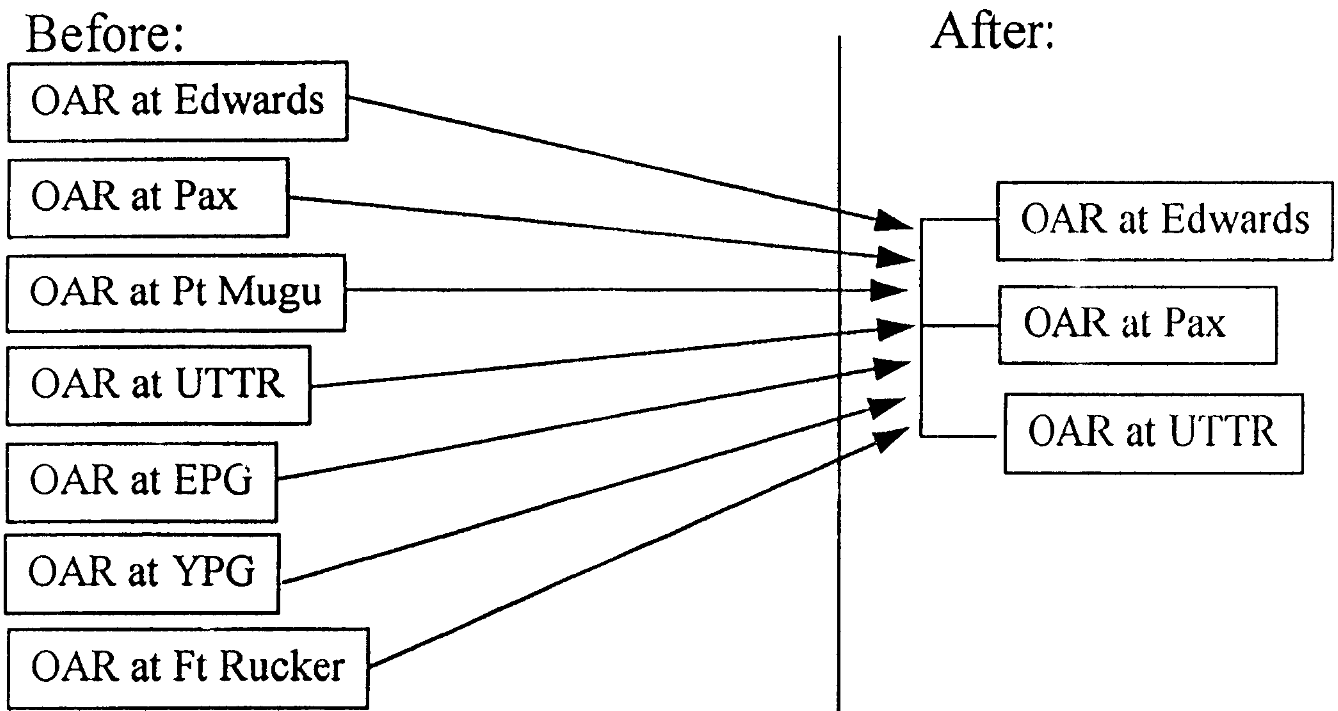
# Optimization Model Output (Test Hours)
## Air Vehicles T&E

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| **AFFTC, Edwards** | **85** | **1273** | **3392** | **81806** | | 1968 | 11998 |
| **NAWC, Pax River** | **81** | | **30703** | **0** | **114171** | 7706 | 12246 |
| **NAWC, Pt Mugu** | **69** | | **575** | | | | 3334 |
| **AFDTC, Eglin** | **58** | | **0** | | | | |
| 476 WEG, Tyndall | 47 | | | | 0 | | |
| **UTTR, Hill** | **46** | | | | | | 0 |
| AQTD, Edwards | 46 | | | | | | 0 |
| **EPG, Ft Huachuca** | **44** | | **0** | | | | 0 |
| **NAWC, China Lake** | **43** | | **0** | | | | |
| **YPG, Yuma** | **35** | | **0** | | | | 0 |
| ATTC, Ft Rucker | 34 | | | | | | 0 |
| **AFDTC, Holloman** | **33** | | **27985** | | | | |
| NSWC, Dahlgren | 25 | | 943 | | | | |
| NAWC, Indianapolis | 19 | | 21013 | 0 | | | |
| **AEDC, Arnold** | **18** | | **0** | | | | |
| NAWC, Warminster | 14 | 0 | | | | | |

**Capability/Capacity Analysis for Air Vehicles T&E**

# Open Air Range

Mismatches: Cruise Missile Testing at UTTR




**Before:**

7 Ranges (9 Facilities)
8 Activities
Capacity = 53761 Test Hours
Excess Capacity = 26183 Test Hours

**After:**

3 Ranges (4 Facilities)
4 Activities
Capacity = 30250 Test Hours
Excess Capacity = 2672 Test Hours

## Capability/Capacity Analysis for Air Vehicles T&E

# Adjusted Optimization Model Workload (Test Hours)

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| **AFFTC, Edwards** | **85** | **270** | **2360** | **71417** | | **121** | 13395 |
| **NAWC, Pax River** | **81** | | **27405** | **11065** | **130822** | **10496** | 9340 |
| **NAWC, Pt Mugu** | **69** | | **0** | | | | 0 |
| **AFDTC, Eglin** | **58** | | **5238** | | | | |
| 476 WEG, Tyndall | 47 | | | | 0 | | |
| **UTTR, Hill** | **46** | | | | | | 2217 |
| AQTD, Edwards | 46 | | | | | | 2626 |
| **EPG, Ft Huachuca** | **44** | | **0** | | | | 0 |
| **NAWC, China Lake** | **43** | | **2095** | | | | |
| **YPG, Yuma** | **35** | | **0** | | | | 0 |
| ATTC, Ft Rucker | 34 | | | | | | 0 |
| **AFDTC, Holloman** | **33** | | **27677** | | | | |
| NSWC, Dahlgren | 25 | | 0 | | | | |
| NAWC, Indianapolis | 19 | | 0 | 0 | | | |
| **AEDC, Arnold** | **18** | | **2569** | | | | |
| NAWC, Warminster | 14 | 0 | | | | | |

# Air Vehicles T&E
# Potential Realignment Opportunities

- Non-Core (JCSG) Alternatives
  - TE-1 (AV): Realign Ft Rucker Rotary Wing OAR to YPG
  - TE-2 (AV): Realign AQTD Rotary Wing OAR to YPG
  - TE-3 (AV): Realign NAWC, Indianapolis ILs to Pax River and Realign NAWC, Indianapolis Product Quality Assurance MF to TBD
  - TE-4 (AV): Realign NSWC, Dahlgren EM Vulnerability MF to Pax River
  - TE-5 (AV): Realign NAWC, Warminster DM&S Centrifuge to Pax River
  - TE-6 (AV): Realign Tyndall RADAR Test HITL to Another Air Force Activity
- Core Alternative
  - Core-1 (AV): Consolidate OAR Workload into Three MRTFB Ranges: AFFTC Edwards, NAWC Pax River, and UTTR Hill
- Additional Core:
  - Sea Level Climatic Workload from Pt Mugu to McKinley Climatic Lab, Eglin

# Recap
# Air Vehicle T&E

| Options | Activities | Facilities | DoD Capacity (Test Hours) | DoD Excess Capacity (Test Hours) | Comments |
|---|---|---|---|---|---|
| Baseline | 16 | 51 | 509,612 | 190,499 | |
| Non-Core (JCSG) Alternatives | 10 <37%> | 46 <10%> | 486,210 <5%> | 167,097 <12%> | Non-Core Realigned |
| Core-1 (AV) OAR Realignment | 11 <31%> | 43 <16%> | 474,965 <7%> | 155,852 <18%> | Non-Core Realigned Plus MRTFB OAR Consolidation |
| Add'l Alternative * | 10 <37%> | 42 <18%> | 474390 <7%> | 155604 <18%> | Core and Non-Core Realigned |

* Maximum Reductions Achievable

<> = % Reduction

# T&E Functional Analysis/Results

## Recap

- Realign DoD Air Vehicles T&E Into AFFTC (Edwards) and NAWC (Pax River), to Include Rotary Wing
  - Both Required to Satisfy DoD Requirements
- Realign DoD A/W OAR T&E Into AFDTC (Eglin) and Army WSMR
  - Both Required to Satisfy DoD Requirements
  - Retain Navy Ground Facilities to Support Weapons R&D
- Realign EC OAR T&E from NAWC (China Lake) to Nellis Complex and AFDTC (Eglin)
  - Combined with Consolidation of EC Ground Facilities at AV Principal Sites, Satisfies DoD Requirements
- Retain Required Specialty Sites to Support Above
  - AEDC
  - AFDTC (Holloman)
  - UTTR (Air/Land Space)

# T&E JCSG Co-Chair Alternatives

## (22 Nov 94 Transmittal Memo)

- Co-Chair Alternatives Address Either/Or Options Which Include Realignment of All T&E (AV, A/W, & EC) Between "Core" Activities
  - AFFTC (Edwards) vs NAWC (Pax River)
  - AFDTC (Eglin) vs NAWC (China Lake)
  - NAWC (Pt Mugu) to NAWC (China Lake) or AFDTC (Eglin)
  - Army Rotary Wing T&E (Ft Rucker & AQTD/Edwards) to AFFTC (Edwards) or NAWC (Pax River)
    - Only If Fixed Wing AV T&E Consolidated at One Site

# T&E JCSG Co-Chair Alternatives

## Assessment

| Primary T&E Areas | Control Number | Proposed Realignment Alternative | Supported by Analysis | * Alternative Based on Analysis |
|---|---|---|---|---|
| AV (Rotary Wing) | T&E-1<br>T&E-4<br>T&E-7** | NAWC (Pax) to AFFTC (Edwards)<br>AFFTC (Edwards) to NAWC (Pax)<br>ATTC (Ft Rucker)/AQTD (Edwards) to AFFTC (Edwards) or NAWC (Pax) | No<br>No<br>Yes | • Realign to AFFTC (Edwards) and NAWC (Pax) |
| AW & EC | T&E-2<br>T&E-3<br>T&E-6<br>T&E-5 | AFDTC (Eglin) to NAWC (CL)<br>NAWC (CL) to AFDTC (Eglin)<br>NAWC (Pt Mugu) to AFDTC (Eglin)<br>NAWC (Pt Mugu) to NAWC (CL) | No<br>Yes<br>Yes<br>No | • Realign NAWC (CL) and NAWC (PM) A/W into AFDTC (Eglin)<br>• Realign NAWC (CL) EC OAR to Nellis Complex and AFDTC (Eglin) |

* Based on Completion of T&E JCSG Analysis Plan
** Only if Fixed Wing AV T&E Consolidated at One Site

# Part II: Summary

- Only Parts of T&E JCSG Co-Chair Alternatives Supported by Analysis of T&E JCSG Data
  - In All Cases, AF Preferred Receiver Site
- Significant Reductions in Excess Capacity Possible Through Implementation of T&E JCSG Alternatives for "Non-Core" Activities
  - Combined with Intra-Service Realignment Opportunities, Significantly More Reductions possible
- Significant Cost/Savings Possible By Implementing Alternatives for "Core" T&E Activities, as well as Further Reductions in Excess Capacity
  - OAR Alternatives Provide Greatest potential for Savings
  - Ground Facility Alternatives Offer Decreasing Potential for Savings, and Greatest impact on Other Mission Areas (e.g., S&T, R&D, ISE, etc.)

# Air Force BRAC '95 Analysis of T&E Infrastructure

<u>Part III:</u> Analysis of RDT&E Alternatives for Armament/Weapons, Explosives, and Propulsion

# Air Launched Weapons RDT&E
## Background

- LJCSG Chair Alternatives (29 Nov 94 Memo #4)
  - Proposes to Consolidate Fixed Wing, Air-Launched (A-A/A-S) Weapons at NAWC (China Lake)
  - AF Did Not Analyze Since Not Developed Jointly and No Supporting Analysis Provided
- OSD(ES) Clarification of DepSecDef's 7 Jan 94 Memorandum (27 Dec 94)
  - Expanded to Include Alternatives Provided by JCSG Chairs (vs Jointly Developed)
- LJCSG Chair Provided Supporting Analysis
  - Conceptual Approach for Integrating Lab (R&D) and T&E JCSG Results
  - Analysis Only Addressed Lab Activities
  - AF Proceeded with Evaluating R&D Portion of Alternatives Only
- Since No T&E Analysis Provided to Support RDT&E Alternative, AF Completed T&E Analysis for "Core" T&E Activities (See Part II)
  - Used Results, Along with LJCSG Data, to Address RDT&E Alternatives

# LJCSG RDT&E Integration Concept

| | Labs | | | | T&E Sites |
|---|---|---|---|---|---|
| | | FV | FC | Load | |
| Common Support Function(s) | | | | | |
| | Lab A | | | | T&E A |
| | Lab B | | | | T&E B |
| | Lab C | | | | T&E C |
| | Lab D | | | | |
| | | | | | |
| Common Support Function | | | | | |
| | Lab A | | | | T&E A |
| | Lab B | | | | T&E B |
| | Lab C | | | | T&E C |
| | | | | | |
| Look Across Sub-Categories (Macro View) | | | | | |

# LJCSG RDT&E Integration Concept (Analysis Ground Rules)

- Integrate RDT&E Functions
- Move Lab Activities to T&E Sites Due to Range Space
- Move From Lower to Higher Functional or Military Values
- Roll Up/Look For Activity/Installation Alternatives

# Air Launched Weapons RDT&E
## Scope

- RDT&E
  - Includes S&T and EMD (Excludes ISE)
- Fixed-Wing A-A/A-G Weapons
  - Surface-to-Surface T&E Excluded
  - Includes 5 CSFs
    - Conventional Missiles and Rockets
    - Guided Projectiles
    - Bombs
    - Guns/Ammo (Added)
    - Cruise Missile
  - Excludes Land, Sea, and Rotary-Wing Launched Weapons
- Lab Activities Include
  - 3 AF (1 Added)
  - 10 Navy (5 Added)
  - 4 Army (All Added)
- Energetics-Explosives Integral Part of Weapons RDT&E

# Air Launched Weapons RDT&E
## Analysis Process

1
- Use LJCSG Data for Conventional Weapons as Starting Point
  - S&T, EMD, ISE
  - Capacity/Requirement
  - Combined 5 CSFs

2
- Extract R&D Data for Air-Launched Weapons
  - Exclude ISE
  - Exclude Sea & Land Launched R&D

3
- Select Best T&E Activity/Site for RDT&E Consolidation
  - Based on Analysis of T&E JCSG Data
  - Preserves Critical Air, Land, & Sea Space
  - Minimizes Number of Sites (& Cost) Req'd

4
- Consolidate DoD R&D Workload for Air-Launched Weapons at T&E Site
  - Combine All Relevant R&D Activities at Site
  - Conduct Capability/Capacity Analysis
  - Identify Shortfalls/Solutions
  - Identify Impacts

5
- Best Consolidation Site for Air-Launched Weapons RDT&E
  - Assess Impacts on Other Missions/Activities

6
- Conduct Functional COBRA Analysis

# Air Launched Weapons RDT&E
## *Best T&E Activity/Site

| | Requirement | AFDTC (Eglin) | NAWC (China Lake) |
|---|---|---|---|
| Functional Value | | **82** | 57 |
| OAR Capacity (Test Hours) | N/A | **16,036** | 3,986 |
| A/W Flight Tests Per Year | N/A | **582** | 118 |
| Air Space (sq mi) | 50,000 | **93,143** | 19,445 |
| DoD Land Space (sq mi) | (1) 21,000 | **724** | 1693 |
| Sea Space (sq mi) | 50,000 | **91,998** | None |
| Max Straight Line (nm) | A-A = 220 | (2) **478** | 60 |
| | A-S = 350 | **478** | 60 |
| | S-A = 240 | (2) **478** | 60 |

Note: (1) No activity meets 21,000 sq mi DoD Land Space Requirement WSMR's 3,381 sq mi DoD Land Space is max
(2) Includes Theater Missile Defense Capability

* Based on Part II T&E Analysis

# DoD R&D Capacity/Requirement* (Workyears)
## Analysis of LJCSG Data

| | Activity | Land-Launched | Air-Launched | Sea-Launched |
|---|---|---|---|---|
| Air Force | ASC/WL Eglin | | 1755/1124 | |
| | ASC WPAFB | | 325/208 | |
| | **AF Subtotal** | | **2080/1332** | |
| Army | MRDEC Redstone | 1941/1243 | 485/312 | |
| | ARDEC Picatinny | 1522/975 | 169/109 | |
| | ARL APG | 242/155 | 27/17 | |
| | Benet (Army) | 223/143 | | |
| | **Army Subtotal** | **3928/2516** | **681/438** | |
| Navy | NAWC Pt Mugu | | 12/7 | 11/8 |
| | NAWC China Lake | | 608/390 | 607/388 |
| | NAWC Pax River | | 9/6 | 3/2 |
| | NSWC Dahlgren | | 72/47 | 652/417 |
| | NSWC Indian Head | | 38/24 | 37/24 |
| | NSWC Crane | | 46/30 | 12/7 |
| | NAWC Indianapolis | | 14/9 | 2/1 |
| | NSWC Pt Hueneme | | | 21/14 |
| | NSWC Louisville | | 4/3 | 36/23 |
| | NCCOSC RDTE | | | 9/6 |
| | **Navy Subtotal** | | **803/516** | **1390/890** |
| | **DoD Total** | **3928/2516** | **3564/2286** | **1390/890** |

* Estimated Using Certified Data

# Air-Launched Weapons RDT&E

## R&D Assessment

## (Functional Requirement/Excess Capacity)

| | Eglin | China Lake | Comments |
|---|---|---|---|
| Before Intra-Service Consolidations | 1124/631 | 390/218<br><br>516/287 (Total Navy) | Eglin Can Absorb China Lake<br>- But Not Vice Versa<br>Eglin Can Absorb Total Navy Req't<br>- But Not Vice Versa |
| After Intra-Service Consolidations | 1332/423 | 608/0 | Requires Second Navy Site to Accomodate 798 Work Years to Meet Total Navy Requirement |

Note:
- Eglin Has Full R&D Capability (i.e., Collocated Acquisition) vs Partial Capability at China Lake (i.e., Acquisition at Crystal City)
- Even Assuming China Lake 100% Air-Launched, Eglin Short Fall Only 147 Workyears versus 687 for China Lake

# Air Launched Weapons RDT&E
# Recap

- Eglin (vs China Lake) is Best Alternative for Consolidation of Fixed-Wing Air-Launched Weapons RDT&E
  - Based on Analysis of T&E and Lab JCSG Data
  - Full Capability and Capacity to Satisfy Requirements
  - Leverages Same RDT&E Resources to Support Collocated S&T, SPO, DT&E and Operational Test, Training and Tactics Development Users
  - Significant Joint and Cross-Servicing Activity Already in Place (e.g., AMRAAM, JDAM, LOCAAS, Hellfire Test Complex, Project Chicken Little, etc.)
- Energetics-Explosives RDT&E Treated as Integral Part of Weapons RDT&E
  - No Separate Analysis



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# Energetics-Propulsion S&T Capabilities

| Site | Solids | | Liquids | | | |
|---|---|---|---|---|---|---|
| | Research Labs | Propellant Mix Capabilities | Mono & Bi-Propellants | Cryogenic Propellants | Electrics/ Solar | High-Energy Density Materials |
| PL | Yes | Yes | Yes | Yes | Yes | Yes |
| CL | Yes | Yes | No | No | No | No |
| RTTC | Yes | UNK | No | No | No | No |

PL = Phillips Lab (AF)
CL = China Lake (Navy)
RTTC = Redstone Technical Test Center (Army)

# Air Launched Weapons RDT&E
## Summary (Cont'd)

- Similar to T&E Analysis, Significant Opportunities Exist for Navy and Army for Intra-Service R&D Consolidation
  - Army Could Consolidate from 4 to 2 Activities
  - Navy Could Consolidate from 10 to 2 Activities
  - Air Force is Already Consolidated at 2 Locations (Could go to 1)

# ENERGETICS - PROPULSION T&E CAPABILITIES

| Site | Replacement Value ($M) | Ambient Facilities | | | | Altitude | Altitude Facilities | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Liquids | | Solids | | | Liquids | | Solids | |
| | | No. | Thrust (lbf) | No. | Thrust (lbf) | | No. | Thrust (lbf) | No. | Thrust (lbf) |
| PL | $ 188.80 | 7 | 10,000 K | 13 | 6,000 K | 100 K ft | 1 | 50 K | 2 | 100 K |
| CL | $ 19.59 | 1 | 300 K | 8 | 1,500 K | - | 0 | - | 0 | - |
| RTTC | $ 4.05 | 1 | 150 K | 6 | 2,000 K* | - | 0 | - | 0 | - |
| AEDC | $1,000.00 | 0 | - | 0 | - | 125 K ft | 2 | 1,500 K | 2 | 750 K |

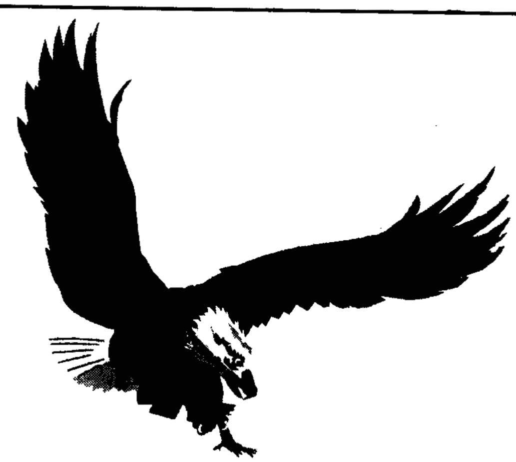
* RTTC has a concrete pad for thrust of 10,000 K lbf, but not demonstrated and not instrumented

# Summary

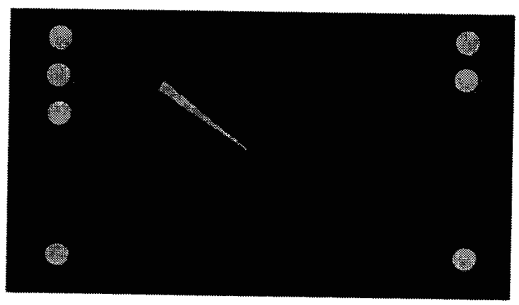
- AF Core T&E Capabilities/Workload Consolidated to Maximum Extent Possible Based on Intra-AF Analysis
  - Eliminates All Excess Capacity Linked to I/S Savings
  - Leaves Capability/Capacity For Cross-Servicing
  - T&E JCSG Cross-Servicing Opportunities Being Worked
- Completion of T&E JCSG Analysis Plan Shows That AF T&E Activities Are Preferred Consolidation Sites
  - Subset of T&E JCSG Co-Chair Alternatives
  - Significant Cost/Savings and Reductions in Excess Capacity Achievable Beyond T&E JCSG Alternatives
  - Could Have TOA and End Strength Implications

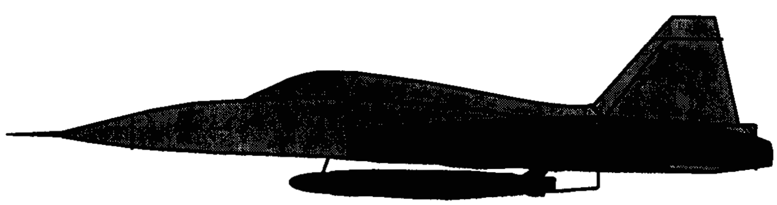
# Summary (Cont'd)

- Combined Lab/T&E Analysis of LJCSG Chair Alternative to Consolidate RDT&E of Conventional Weapons Shows Eglin Better Consolidation Site (versus China Lake)
  - Energetics-Explosives an Integral Part
- Similar Analysis for Energetics-Propulsion Shows PL(Edwards) Better Consolidation Site (versus China Lake)
  - Combined with AEDC, Provides Capability to Satisfy DoD Requirements
- Significant Opportunities for Intra-Navy and Intra-Army Consolidations
  - Intra-Service Consolidations Should Be a Prerequisite Before Inter-Servicing Considered



# Air Force BRAC '95 Analysis of T&E Infrastructure





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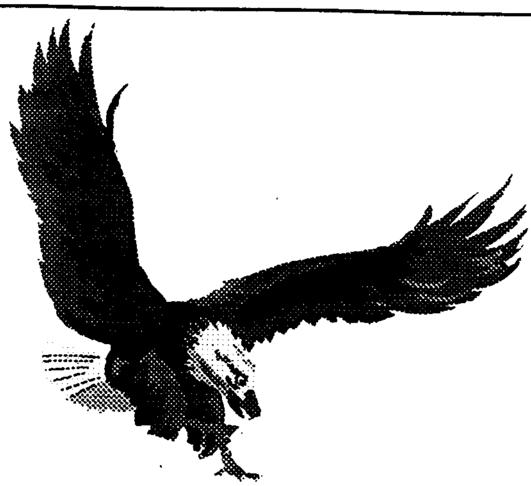

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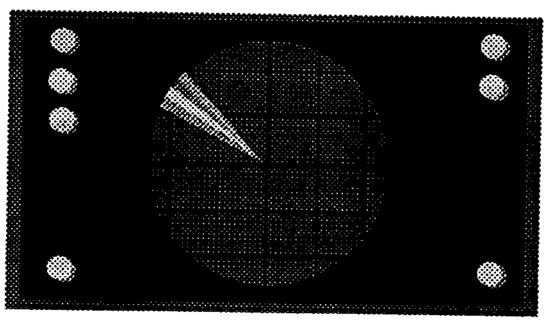

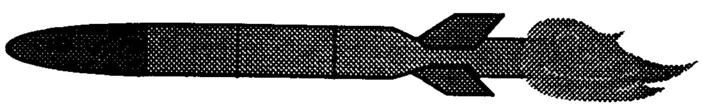

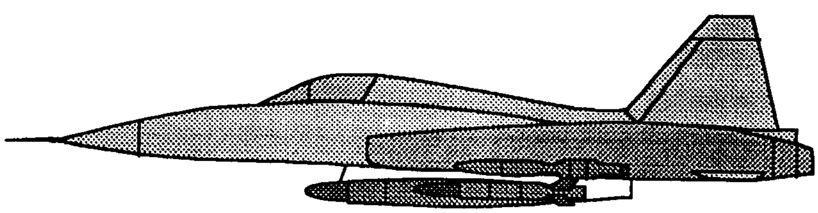

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# CONTENTS

## EXECUTIVE SUMMARY

### Background

DepSecDef's 7 January 1994 memo (reference 1) established Joint Cross Service Groups (JCSGs), the BRAC Steering Group, and the BRAC Review Group with OSD Chairs and MilDep members to oversee the BRAC '95 cross-servicing activities. It, with other OSD policy memoranda, also established the authorities, responsibilities, policies, and procedures for conducting cross-servicing analyses and recommending realignment/consolidation alternatives for consideration by the MilDeps.

From February 1994 through November 1994, the T&E JCSG gathered certified data, conducted analysis in accordance with its jointly developed plan approved by the BRAC Steering Group, and provided recommended alternatives to the MilDeps in the T&E JCSG Co-Chair's memorandum of 22 November 1994 (reference 2). In order to meet the required delivery date to the MilDeps, the T&E JCSG deferred to the MilDeps the analysis of "core" T&E activities in the development of their alternatives, as well as COBRA analyses.

The T&E JCSG alternatives consisted of two types: (1) Alternatives that were jointly developed based on joint analysis, herein referred to as the "T&E JCSG Alternatives;" and (2) additional alternatives added by the Co-Chairs that were not jointly developed or supported by analysis, herein referred to as the "T&E Co-Chair Alternatives." In addition, the Lab JCSG (LJCSG) Chair provided additional alternatives in its 29 November 1994 memo (reference 3) involving both T&E and R&D, herein referred to as the "LJCSG Chair RDT&E Alternatives." Although the LJCSG Chair provided a conceptual model for development of RDT&E alternatives, only a limited analysis was provided for the R&D (Lab) portion. No T&E specific analysis was provided to support the proposed RDT&E alternatives.

The T&E JCSG Alternatives were confined to "non-core" T&E activities since the T&E JCSG excluded "core" T&E activities as candidates for realignment/consolidation during their joint development of alternatives. On the other hand, the T&E Co-Chair Alternatives, proposed separately by the Co-Chairs and after the joint development of the T&E JCSG Alternatives for "non-core" T&E activities, specifically addressed "core" T&E activities. During the process, 12 activities were designated as "core" T&E activities, and thus excluded by the T&E JCSG in their joint deliberations as realignment/consolidation candidates, and the remaining 11 activities were designated as "non-core."

The Air Force evaluated the jointly developed T&E JCSG Alternatives for "non-core" activities by integrating them into its BRAC '95 recommended alternatives and offering to cross-service the Army and Navy for those alternatives which identified the Air Force as a potential receiver. The Air Force also sent requests for data to the other Services, where the Air Force was identified as the potential losing activity, and conducted COBRA analyses in accordance with the procedures approved by the BRAC Steering Group. Although similar requests were received from the Army, no requests for data for the T&E JCSG Alternatives were received from the Navy for those T&E JCSG Alternatives listing the Navy as the potential losing activity.

On the other hand, the Air Force did not respond to the T&E Co-Chair Alternatives for "core" activities since no T&E analysis was provided to support them. Similarly, the Air Force did not analyze the T&E portion of the LJCSG Chair RDT&E Alternatives since no T&E-specific analysis to support those alternatives was provided.

Because the Air Force shares the concern of the Co-Chairs that analysis of "core" alternatives is necessary, it chose to complete the T&E JCSG analysis plan for "core" T&E activities on its own. For similar reasons, the Air Force combined the T&E JCSG data and results with further analysis of the LJCSG certified data to provide a complete analytical basis for addressing the RDT&E alternatives. The results of the Air Force's intra-service analysis, and integration of the T&E JCSG Alternatives into that analysis, are included for completeness.

## Purpose

The primary purpose of this report is to document the analyses conducted in support of the Air Force BRAC '95 Installation and cross-servicing activities.

Specifically, this report documents how the Air Force has analyzed the T&E JCSG Alternatives, evaluated these cross-servicing opportunities, and integrated them into its intra-Air Force analysis. The report also documents completion of the T&E JCSG analysis plan for "core" T&E activities, for determining if these additional alternatives are supported by analysis of certified data. This analysis was completed by the Air Force T&E BRAC team in accordance with an approved T&E JCSG analysis plan using certified data. Similarly, the analyses addressing the LJCSG Chair RDT&E alternatives are included for completeness.

The report is divided into three parts: Part I ("Intra-Air Force T&E Realignments/Consolidations") summarizes the results of the Air Force's analysis of its T&E

infrastructure, along with its evaluation of the T&E JCSG Alternatives for "non-core" T&E activities, their integration into the Air Force BRAC installation analyses, and the pursuit of these alternatives with the Army and Navy as cross-servicing opportunities. Part II ("Completion of the T&E JCSG Analysis Plan") summarizes the results of completing the T&E JCSG Analysis Plan for "core" T&E activities, thus providing an analytical basis for addressing the T&E Co-Chair Alternatives. Part III ("Analysis of RDT&E Alternatives for Armament/Weapons, Explosives, and Propulsion") summarizes the results of combining the T&E JCSG data and results with further analysis of the LJCSG certified data to provide an analytical basis for addressing the LJCSG Chair RDT&E Alternatives.

**Results**

Part I shows that the Air Force core T&E capabilities for Air Vehicles and Armament/Weapons are already consolidated at AFFTC (Edwards) and AFDTC (Eglin), respectively, with one exception AFFTC (UTTR). On the other hand, the Air Force core T&E capabilities for Electronic Combat are fragmented at several different locations. Three EC realignments involving AFDTC (REDCAP), AFDTC (AFEWES), and AFDTC (Eglin) EC open-air range, along with one realignment involving AFFTC (UTTR), were evaluated and included in the Air Force BRAC '95 Recommendations. With these realignments, the Air Force will have consolidated its core T&E capabilities into the fewest possible T&E activities/sites to support the Air Force primary mission and the test process. In addition to its full-spectrum test centers, AFDTC (Eglin) and AFFTC (Edwards), specialized test capabilities, which are geographically constrained or cost prohibitive to move and required to support the test process, are retained at AEDC (Arnold), AFDTC (Holloman), and the Nellis Range Complex. Comparison with the other Services shows that significant intra-Service consolidation opportunities also exist within the Navy (nine T&E activities) and the Army (seven T&E activities).

Part II shows that only three of the seven T&E Co-Chair Alternatives for "core" T&E activities are supportable, based on analysis of the T&E JCSG certified data using the T&E JCSG Analysis Plan approved by the BRAC Steering Group. In all cases, the T&E JCSG approved optimization model runs selected Air Force sites as the preferred receiver sites. This outcome is as expected since the principal Air Force T&E activities scored the highest Functional Values for each T&E Functional Area (i.e., AFFTC (Edwards) for Air Vehicles, AFDTC (Eglin) for Armaments/Weapons, and AFDTC (Eglin) for Electronic Combat). Contrary to the T&E Co-Chair Alternatives for consolidating all Air Vehicle Fixed-Wing T&E at either AFFTC (Edwards) or NAWC (Pax River), analysis shows that both are needed to satisfy projected workload and DoD T&E requirements. In addition, these two sites, along with specialized facilities at a few other locations, satisfy all DoD T&E requirements and can handle all rotary-wing T&E as well, contrary to the T&E Co-Chair Alternative to consolidate rotary-wing T&E only if fixed-wing T&E is consolidated at one site. Similarly, contrary to the T&E Co-Chair Alternatives to consolidate Armament/Weapons and Electronic Combat T&E at NAWC (China Lake), analysis shows that both NAWC (China Lake) and NAWC (Pt Mugu) should be consolidated at AFDTC (Eglin). Combined with WSMR (White Sands), this combination, along with specialized facilities at a few other locations, satisfies all DoD T&E requirements for Armaments/Weapons. Combining the AFDTC (Eglin) and Nellis Range Complex for EC open-air range T&E, along with EC ground facilities at a few other locations, DoD T&E requirements for Electronic Combat are also satisfied.

Part III shows that Eglin AFB is the best alternative for consolidation of DoD fixed-wing, air-launched weapons RDT&E, contrary to the LJCSG Chair RDT&E Alternative to consolidate at NAWC (China Lake). This is based on the T&E JCSG data and results combined with analysis of LJCSG certified data using the LJCSG Chair's integration concept for RDT&E.

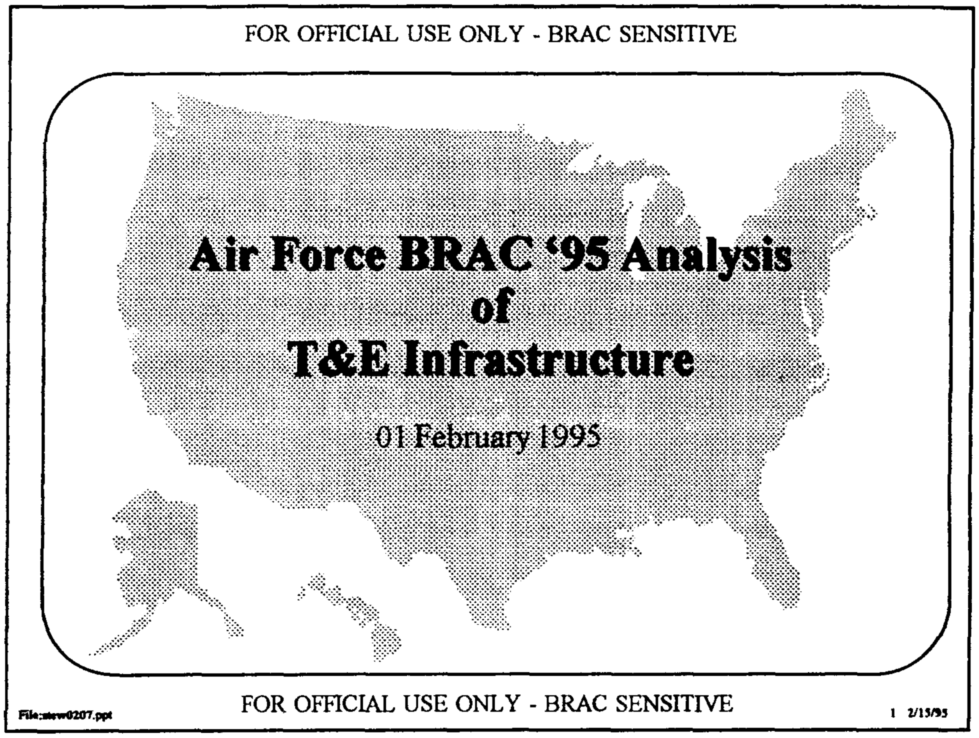
Similar analysis of S&T and T&E capabilities shows that the Air Force Phillips Laboratory (Edwards) is a better alternative for consolidation of Energetics-Propulsion RDT&E then NAWC (China Lake), as recommended in the LJCSG Chair RDT&E Alternatives. Combined with AEDC's $1B capability for altitude testing, this combination can satisfy the total S&T and T&E DoD requirements for Energetics-Propellants.

**Summary**

As shown in Part I, the Air Force entered BRAC '95 with most of its T&E capabilities to support the Air Force mission and test process already consolidated at AFFTC (Edwards) for Air Vehicle and at AFDTC (Eglin) for Armaments/Weapons, along with specialized ground facilities supporting all of DoD at AEDC (Arnold and AFDTC (Holloman). On the other hand, T&E capabilities for Electronic Combat were fragmented at different locations. Combining this with projected workload and recommended T&E JCSG Alternatives, the Air Force identified four additional realignment opportunities to further consolidate Air Force core T&E capabilities in its BRAC '95 recommendations. Two of these requirements were recommended by the T&E JCSG. These recommendations provide the minimum T&E infrastructure and minimum achievable excess capacity possible (i.e., no further savings through facility consolidations) to support Air Force core T&E requirements.

By completing the T&E JCSG Analysis Plan for "core" T&E activities (Part II), the Air Force has shown that further reductions in excess capacity among "core" T&E activities are possible by identifying technically and economically viable alternatives. These alternatives are supported by analysis of certified data and are subsets of the T&E JCSG Co-Chair alternatives. In all cases, Air Force T&E activities are the best consolidation sites for Air Vehicle, Armaments/Weapons and Electronic Combat, consistent with the higher functional values for these activities.

Combining the T&E JCSG data and results with further analysis of the LJCSG certified data (Part III), and using the LJCSG Chair's integration concept for RDT&E, the results clearly show Eglin AFB to be the best consolidation site for fixed-wing air-launched weapons RDT&E. A similar analysis for the Energetics-Propellants RDT&E Alternative shows Air Force Phillips Laboratory (Edwards) to be the best consolidation site. Combined with the Air Force's AEDC (Arnold), these two activities could provide the total capability to satisfy DoD's S&T and T&E requirements for Energetics-Propellants.




## Foreword

This report was prepared by the Air Force T&E BRAC Team to document the analysis conducted in support of the Air Force BRAC '95 Installation and T&E Joint Cross-Service Group (JCSG) analyses. The charts in the main report were presented to the Air Force Base Closure Executive Group (BCEG) on February 1, 1995 to summarize all T&E analysis conducted to support BRAC '95, both intra-AF and cross-servicing. The briefing was also given to the JCSG Co-Chairs on January 27, 1995. Annexes are included to document details of the supporting analysis.

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## Purpose

- Present Results of AF Analysis of T&E Realignment & Consolidation Opportunities
  - Intra-AF
  - Cross-Servicing

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DepSecDef's 7 Jan 94 memo (Ref 1) established Joint Cross Service Groups (JCSGs), the BRAC Steering Group and the BRAC Review Group with OSD Chairs and MilDep members to oversee the BRAC 95 cross-servicing activities. It also established the authorities, responsibilities, policies and procedures for conducting cross-servicing analyses and recommending realignment/consolidation alternatives for consideration by the MilDeps.

From Feb 94 through Nov 94 the T&E JCSG gathered certified data, conducted its analysis in accordance with its jointly developed plan approved by the BRAC Steering Group, and provided recommended alternatives to the MilDeps in the T&E JCSG Co-Chair's memorandum of 22 Nov 94 (Ref 2). In order to meet the required delivery date to the MilDeps, the T&E JCSG deferred completion of the analysis plan to the MilDeps.

The T&E JCSG alternatives consisted of two types: (1) Alternatives that were jointly developed based on joint analysis, herein referred to as the "T&E JCSG alternatives"; and (2) Additional alternatives added by the Co-Chairs that were not jointly developed or supported by analysis, herein referred to as the "T&E Co-Chair alternatives." In addition, the Lab JCSG (LJCSG) Chair provided additional alternatives in its 29 Nov 94 Memo (Reference 3) involving both T&E and R&D, herein referred to as the "LJCSG Chair RDT&E alternatives." Although the LJCSG Chair provided a conceptual model for development of RDT&E alternatives, only a limited R&D (Lab)/T&E analysis was provided to support the proposed RDT&E alternatives.

The purpose of this report is to show how the Air Force has analyzed the T&E JCSG alternatives, evaluated these cross-servicing opportunities, and integrated them into its intra-Air Force analysis. In addition, since there was no T&E analysis provided by the T&E JCSG Co-Chairs to support their additional alternatives, the purpose of this report is also to document completion of the T&E JCSG analysis plan so as to provide some basis for determining if these additional alternatives are supported by analysis of certified data. Since the T&E JCSG deferred completion of the analysis plan to the MILDEPs after delivery of its recommended alternatives in November 1994, this analysis was completed by the Air Force T&E BRAC team in accordance with the approved T&E JCSG analysis plan using certified data.

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## Background

- T&E JCSG Analysis Plan Was Jointly Developed and Approved by BRAC '95 Steering Group
  - Air Vehicles, Air Armament/Weapons and Electronic Combat
  - Test Facility Level
  - Functional COBRA Costs
- T&E JCSG Did Not Complete Analysis IAW Approved Plan
  - "Activity" (e.g. AFFTC, Edwards AFB) versus Test Facility (e.g. ACETEF Facility at Pax River) Focus
    - AF/TE Nonconcurred
  - Activities Classified into "Core" and "Non-Core"
  - Realignments/Consolidations Between "Core" Activities Not Allowed
  - Steps 3 & 4 Deferred to MILDEPs

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The methodology used for the T&E JCSG analysis is documented in Ref 4 and included here as Appendix B. The framework used to support the Analysis is described in Figures 1 & 5.

In order to meet the required delivery date to the MilDeps for recommended alternatives, the T&E JCSG truncated its analysis and focused its development on alternatives at the "Activity" versus "Test Facility" level, as described in Figure 2. In addition, Steps 3 & 4 of the analysis process, as described in Figure 5, were deferred to the MilDeps.

Activities were classified into "core" and "non-core", as described in Figures 3 & 4, and only realignments/consolidations involving "non-core" activities were allowed (i.e., the T&E Joint Cross-Service Working Group (JCSWG) was not allowed to develop any alternatives involving realignments between "core" activities for consideration by the T&E JCSG).

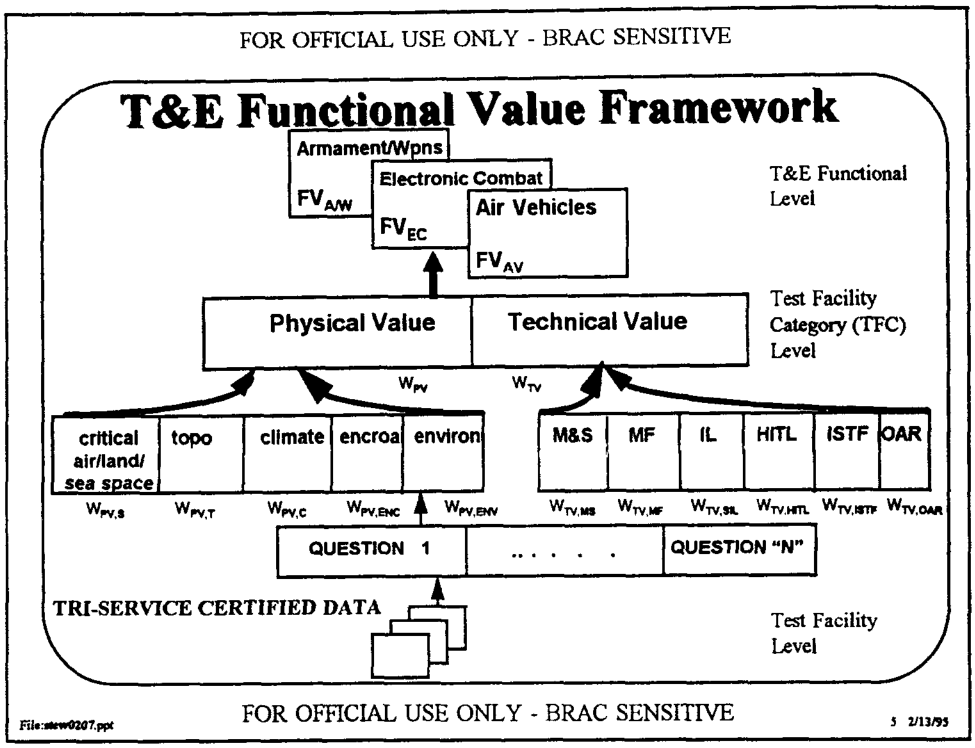


Figure 1

Certified data was gathered from the MilDeps at the Test Facility Level and used to evaluate the technical capabilities of each T&E Activity at the Test Facility Category (TFC) Level. A T&E Activity was defined by the T&E JCSG as any organization located at an installation that owns and operates facilities to support T&E. These values were appropriately weighted and combined to provide a measure of the Activity's Technical Value (i.e., the capability of its technical facilities and T&E infrastructure).

Similarly, certified data were used to determine the Physical Value of the T&E Activity (i.e., the capability of its natural resources). The Technical and Physical Values were combined with appropriate weights to provide the FV at the T&E Functional Level (i.e., Armament/Weapons, Electronic Combat, and Air Vehicles) for each T&E Activity. All weights were approved by the T&E JCSG and BRAC Steering Group.

Similarly, certified data at the Test Facility Level was used to determine capacity (based on demonstrated historical peaks), and projected workload (based on FYDP projections). These results were combined at the TFC level for each Functional Area (i.e., A/W, EC, and AV) and T&E Activity.

The FVs, projected workload and capacities used throughout this report were jointly developed and approved by the T&E JCSG and used as inputs for the T&E JCSG optimization model runs.

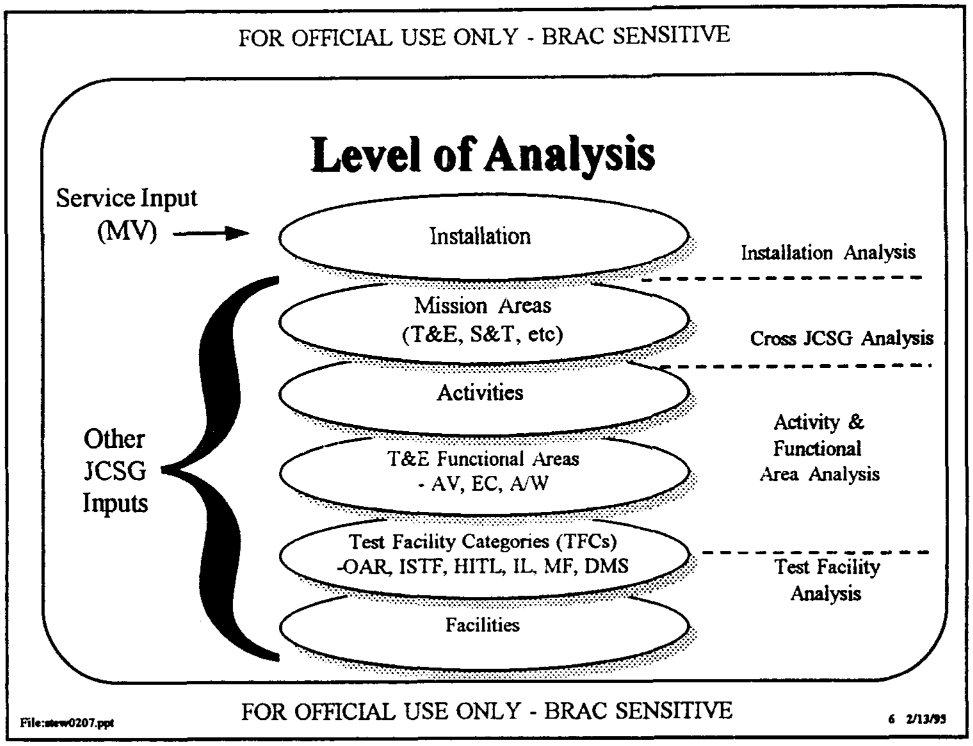


Figure 2

Whereas the focus of the MilDeps was at the installation level, the focus of the T&E JCSG was at the T&E Activity level for each T&E Functional Area (AV, EC, & A/W). As described in the T&E Joint Analysis Plan and discussed earlier, certified data was gathered and analyzed at the Test Facility level to support the development of realignment/consolidation alternatives. However, this level of analysis was not used in the final development of the T&E JCSG Alternatives, thus leading to alternatives only addressing "non-core" activities.

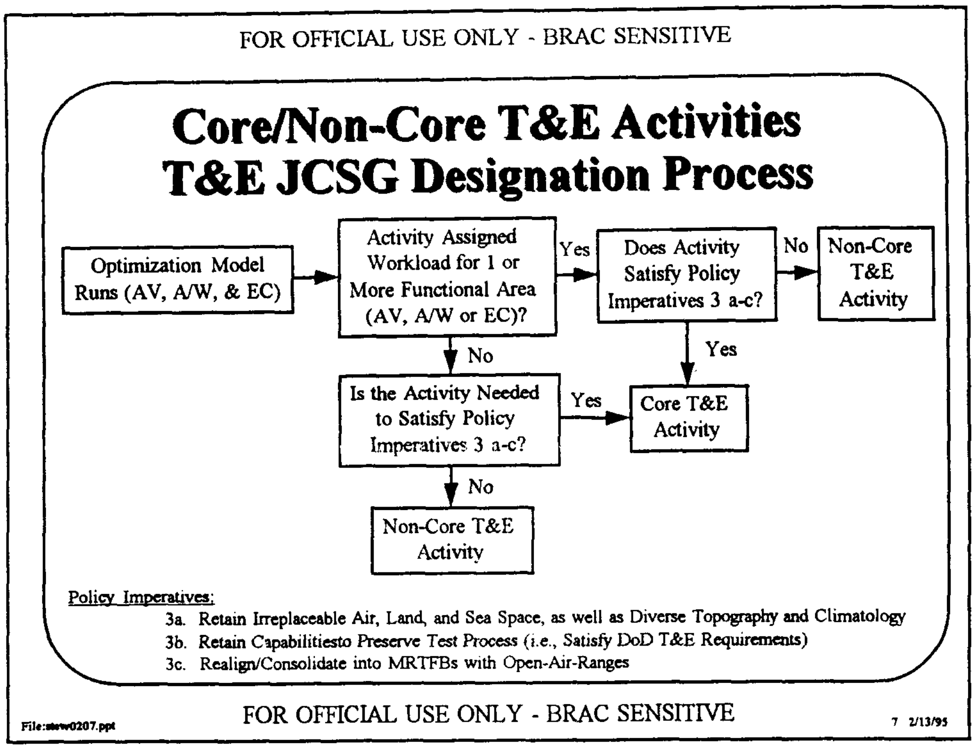


Figure 3

This is the process used by the T&E JCSG to designate T&E activities as "core" and "non-core". The central thesis used was whether or not a T&E activity was assigned workload by the T&E JCSG approved optimization runs for one or more functional area (i.e., AV, A/W, or EC). If this condition was satisfied, as well as the Policy Imperatives in Reference 4 (See Appendix B for copy) approved by the T&E JCSG and BRAC Steering Group, the activity was designated as "core".

Exceptions were made in two cases: (1) Where the model did not assign workload, but the activity was required to retain unique capabilities; or (2) The model did assign workload, but the Policy Imperative to "realign/consolidate into MRTFBs with open-air ranges" was applied to designate it as a "non-core" activity.

This led to additional activities being retained as "core", thus precluding them as candidates for realignment/consolidation alternatives in the joint development of the T&E JCSG alternatives.

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## Core/Non-Core T&E Activities Summary

| MILDEP | Activity (Location) | Core | Non-Core | Retained by Opt Model | Retained as "Core" by T&E JCSG | Rationale |
|---|---|---|---|---|---|---|
| AF | AFFTC (Edwards) | √ | | | | |
| | AFDTC (Eglin) | √ | | | | |
| | AEDC (Arnold) | √ | | | | |
| | AFFTC (UTTR) | √ | | No | Yes | Cruise Missile Capability |
| | AFDTC (Holloman) | √ | | | | |
| | 475 WEG (Tyndall) | | √ | | | |
| | AFEWES (Ft Worth) | | √ | Yes | No | Not MRTFB OAR (PI 3c) |
| | REDCAP (Buffalo) | | √ | | | |
| Navy | NAWC (Pax River) | √ | | | | |
| | NAWC (China Lake) | √ | | | | |
| | NAWC (Pt Mugu) | √ | | | | |
| | NAWC (WSMR) | √ | | No | Yes | Unique Navy S-A Capability |
| | NAWC (Indianapolis) | | √ | | | |
| | NAWC (Warminster) | | √ | | | |
| | NSWC (Dahlgren) | | √ | Yes | No | Not MRTFB OAR (PI 3c) |
| | NSWC (Indian Head) | | √ | | | |
| | NSWC (Crane) | | √ | Yes | No | Not MRTFB OAR (PI 3c) |
| Army | WSMR | √ | | | | |
| | EPG | √ | | | | |
| | YPG | √ | | No | Yes | Unique Army Rotary Wing |
| | RTTC | | √ | | | |
| | ATTC - Ft Rucker | | √ | | | |
| | AQTD - Edwards | | √ | | | |

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Figure 4

To determine whether or not an activity was "core", the T&E JCSWG evaluated six separate optimization model outputs. Five of the model runs were objective functions which did not include military value, the sixth run used military value. If an activity was retained in the majority of the optimization model outputs, then it was initially designated a "core" activity. Conversely, if an activity was realigned in the majority of the optimization model outputs, then it was initially designated a "non-core" activity.

Any "core" activity which did not have an MRTFB open-air range was reclassified as a "non-core" activity, since policy imperative 3c required workload to be realigned into activities with MRTFB open air ranges to the maximum extent possible. Any "non-core" activity which provided a unique capability was reclassified as a "core" activity. As the chart indicates by circles around the checks, AFFTC (UTTR), NAWC (WSMR), and YPG were reclassified from "non-core" to "core" activities for unique cruise missile, Navy surface-to-air, and Army rotary wing capabilities (respectively). AFEWES (Ft Worth), NSWC Dahlgren, and NSWC Crane were reclassified from "core" to "non-core" activities, because they are not MRTFB open air range activities and the workload (testing) was not geographically constrained or unique.

In summary, twelve activities were designated "core" -- five Air Force, four Navy, and three Army. Eleven activities were designated "non-core". The "core" T&E activities are AFFTC (Edwards), AFDTC (Eglin), AEDC (Arnold), AFFTC (UTTR), AFDTC (Holloman), NAWC (Pax River), NAWC (China Lake), NAWC (Pt Mugu), NAWC-WSMR (White Sands), Electronic Proving Ground (Ft Huachuca), and Yuma Proving Ground (Yuma).

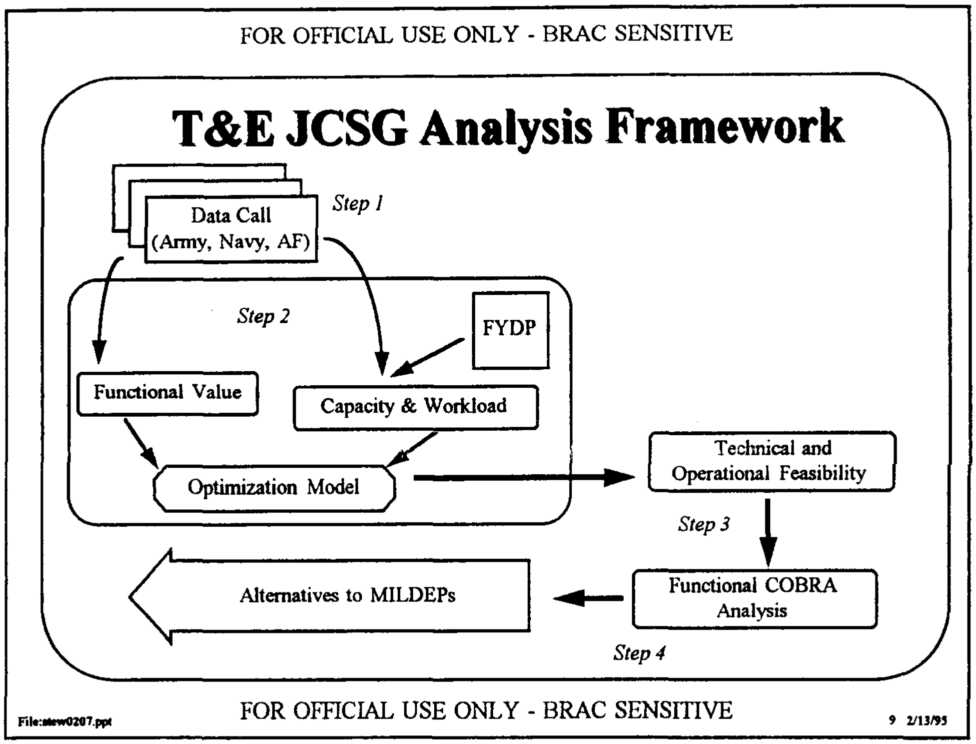


Figure 5

Certified data, gathered at the Test Facility Level, was used by the T&E JCSG to determine FV's, projected workload and capacity for inputs to the Tri-Department Optimization Model. This model was developed by the Navy and approved for use by all JCSGs by the BRAC Steering Group. All inputs and runs using this model had to be approved by the T&E JCSG.

Optimization runs were conducted by the T&E JCSG separately for each T&E Functional Area (AV, A/W/ EC), as well as an integrated run for all three areas combined. The model output provided a starting point for analysis by providing workload assignments to T&E activities based primarily on workload-weighted FV.

Steps 3 & 4 of the analysis, however, were deferred to the MilDeps by the T&E JCSG. These steps are crucial to development of viable alternatives since they were intended to adjust the optimization model outputs for "capability/capacity" mismatches (Step 3) before identifying potential realignment opportunities, and then determining if a realignment was cost-effective (Step 4) before recommending it as an alternative to the MilDeps.

Details of this process are contained in Ref 4 (see Appendix B for copy).

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## Background (con't)

- T&E JCSG Co-Chairs Transmittal to MILDEPs Included Two Sets of Alternatives
  - Jointly Developed Alternatives, Supported By Joint Analysis, Addressing "Non-Core" Activities
  - Co-Chair Alternatives, With No Supporting Analysis, Addressing "Core" Activities
- Air Force Addressed Jointly Developed Alternatives In Its Intra-AF Analysis
  - Offered to Cross-Service Navy and Army in its Response
  - Did Not Respond to Co-Chair Alternatives Since No Supporting Analysis Provided

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Based on the truncated analysis, the T&E JCSG focused on the development of alternatives for "non-core" activities only. These alternatives were supported by joint analysis conducted by the T&E JCSWG.

In its transmittal to the MilDeps (Ref 2), the T&E JCSG Co-Chairs added additional alternatives for "core" activities that were not supported by analysis.

The Air Force incorporated the T&E JCSG alternatives, which identified AF facilities for realignment into its intra-Air Force analysis, integrated them into its BRAC '95 recommendations, and offered to cross-service the Army and Navy where the Air Force was identified as the potential receiving site. The AF also sent requests for data to the other services, where the AF was the potential losing activity, and conducted COBRA analyses in accordance with procedures approved by the BRAC Steering Group.

The Air Force did not evaluate the T&E Co-Chair alternatives since there was no T&E analysis to support their development (Refs 5-7).

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## Background (con't)

- Since T&E JCSG No Longer Active, AF Completed T&E JCSG Analysis Plan, Using Certified Data
  - Results Identify Specific Alternatives for "Core" Activities
  - Addresses Co-Chairs Concerns Regarding Excess Capacity Among "Core" Activities
- AF Combined Results of Above Analysis With Lab JCSG Results to Address Lab JCSG Chair's RDT&E Alternatives
  - Air-Launched Weapons, Propulsion, and Energetics

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After the T&E JCSG transmittal on 22 Nov 94, the T&E JCSG did not meet again to jointly review each Service's response to the T&E JCSG alternatives. In order to be responsive to the T&E Co-Chairs concerns to the MilDeps regarding excess capacity among "core" T&E activities (Reference 2), the Air Force completed the approved T&E JCSG Analysis Plan, as it is described in Reference 4 (see Appendix B for a copy) using certified data. The results of this analysis led to specific alternatives addressing "core" activities, thus providing an analytical basis for specific alternatives for "core" activities.

Similarly, the RDT&E alternatives included in the LJCSG Chair's 29 November 1994 Memo (Ref 3) were not supported by any T&E analysis. The results of the above analysis were combined with the LJCSG certified data and results to specifically address the RDT&E alternatives for Fixed-Wing, Air-Launched Weapons, Energetics-Explosives, and Energetics-Propulsion, thus providing an analytical basis for their consideration.

Since there was never any T&E analysis provided by the T&E JCSG to support the T&E JCSG Co-Chairs alternatives, the Air Force did not respond to these alternatives. On the other hand, since the LJCSG Chair provided an analysis for the R&D (Lab) portion of the RDT&E alternatives, but no T&E specific analysis, the AF initiated efforts to analyze the R&D (Lab) portion by itself. The results of this report substantiate the reasons why this position was taken.

# Overview

- **Part I: Intra-AF T&E Realignments/Consolidations**
  - Basis for Response to T&E JCSG Alternatives
- **Part II: Completion of T&E JCSG Analysis Plan**
  - Addresses T&E Co-Chair Alternatives
- **Part III: Analysis of RDT&E Alternatives for Armament/Weapons, Explosives, and Propulsion**
  - Addresses Lab JCSG Chair's Alternatives



This report is divided into three major parts.

Part I summarizes the results of the Air Force's analysis of its T&E infrastructure, which includes the evaluation of the T&E JCSG alternatives for "non-core" T&E activities and their integration into the Air Force BRAC installation analysis process. In addition to incorporating the recommended T&E JCSG alternatives into the Air Force BRAC '95 recommendations, the Air Force also pursued opportunities for cross-servicing with the Army and Navy for the others.

Part II summarizes the results of the analysis performed by the Air Force to complete the T&E JCSG analysis plan, as it is described in Ref 4 (see Appendix B for copy), using certified data. The results of this analysis provide an analytical basis for realignment/consolidation alternatives for "core" T&E Activities, which were excluded from the T&E JCSG alternatives.

Part III completes the analysis by using the results and certified data from Part II, combined with further analysis of the LJCSG certified data, to provide an analytical basis for the LJCSG RDT&E alternatives, since there was no supporting T&E specific analysis provided.

3

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# Air Force BRAC '95 Analysis of T&E Infrastructure

***Part I: Intra-AF Realignments/Consolidations**

*Update of 12 Dec 94 Briefing for T&E JCSG Meeting, which was not held

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This part of the report was originally intended to be presented at a 12 Dec 94 T&E JCSG meeting. When it was learned that this meeting was intended to be a one-on-one meeting between each MilDep and the T&E JCSG Co-Chairs, the Air Force did not participate. The basis for this decision was that the original DepSecDef's 7 Jan 94 Memo set up a joint process for developing and evaluating cross-servicing alternatives, and that the one-on-one meetings were not consistent with that process.

The Air Force reiterated that it would brief its results to the full T&E JCSG provided the other MilDep's would do the same. Since there was never another T&E JCSG meeting held, the Air Force provided the results of its analysis of the T&E JCSG alternatives in its 14 Dec 94 Memo to the T&E JCSG Co-Chairs. To ensure the other MilDep's had received it, the Air Force T&E Principal on the T&E JCSG sent copies to the other MilDep's T&E Principals (Ref 8).

The original briefing has been updated to include the final results of the Intra-Air Force analysis which includes the "non-core" T&E JCSG cross-servicing alternatives.

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## Purpose

- Present Results of Air Force Base Installation Analysis for T&E
  - Intra-AF T&E Realignments/Consolidations
  - Integration of T&E JCSG Alternatives
  - Basis for Response to T&E JCSG

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The purpose of Part I is to present the results of the Air Force's analysis of its T&E infrastructure. Intra-Air Force opportunities for realignment/ consolidation are addressed, along with the evaluation and integration of the T&E JCSG alternatives for "non-core" T&E activities into the Air Force analysis.

The results of this analysis formed the basis for the Air Force's response to the T&E JCSG (Ref 5 & 9) and the other MilDeps regarding the evaluation of cross-servicing opportunities. It also formed the basis for incorporating T&E JCSG alternatives and other Air Force T&E realignments into the Air Force BRAC '95 recommendations.

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## Part I: Outline

- Scope
- Analysis Process
- Intra-AF Realignments
- JCSG Alternatives
- Summary

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Part I is divided into five sections.

After describing the scope and analysis process, the analysis and results of the intra-Air Force realignments is covered, followed by an evaluation and integration of the T&E JCSG alternatives into the Air Force base installation analysis.

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## Scope

- Focus of T&E JCSG Analysis on AF Primary Mission...Air Warfare
  - Air Vehicles
  - Air Armament/Weapons
  - Electronic Combat
- Other Services' Primary Missions Excluded
  - Navy: Surface and Subsurface Warfare
  - Army: Land Warfare

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The T&E functional areas identified by the T&E JCSG as having the greatest potential for cross-servicing were Air Vehicles, Air Armaments/Weapons, and Electronic Combat. All three of these areas are core to supporting the Air Force primary mission--Air Warfare. Unique air warfare equipage requirements drive the need for test and evaluation facilities capable of supporting integrated development and acquisition of air vehicles, air armaments/weapons, and electronic combat systems.

On the other hand, other Services' primary missions in surface/subsurface and land warfare were excluded from the T&E JCSG analysis.

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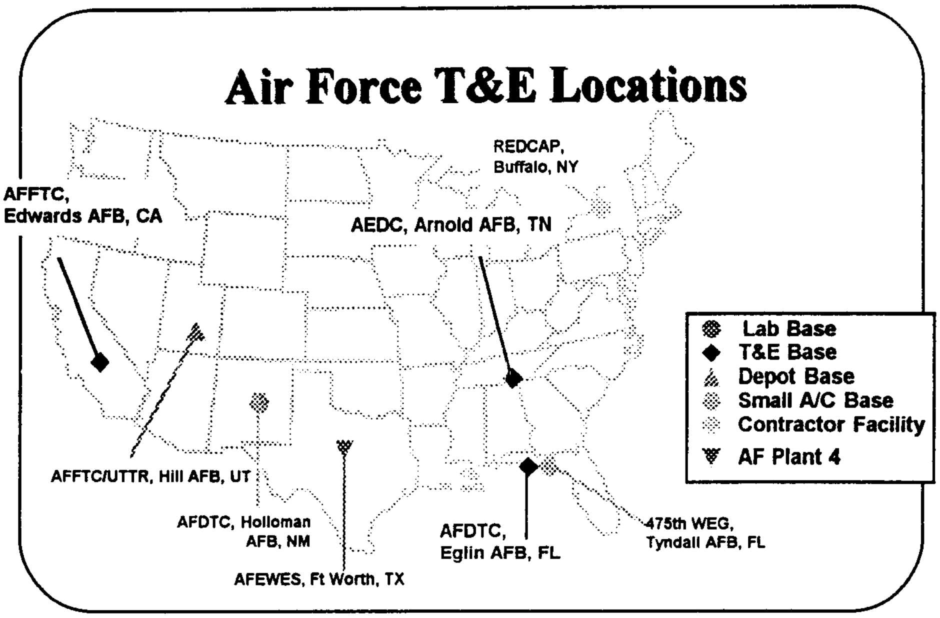


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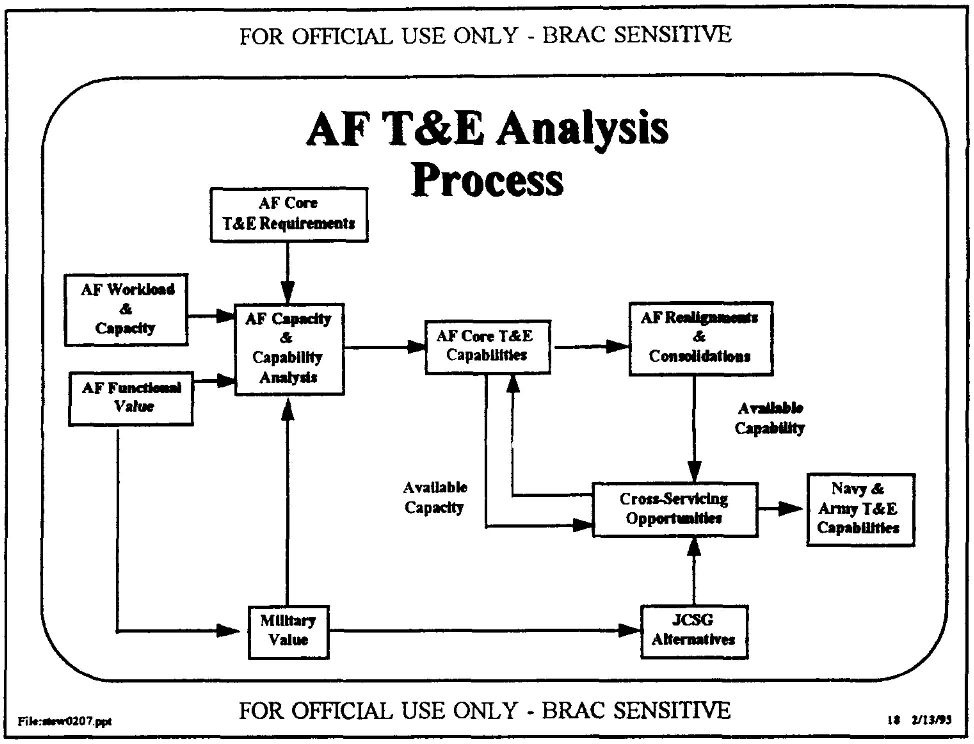
The three Air Force Centers are located at T&E bases as shown. Other T&E facilities supporting the test-process and providing core T&E specialized facilities are located at non-T&E bases. The two remaining facilities (REDCAP and AFEWES) are located at a contractor installation and Air Force Plant 4, respectively.




The original plan was to use the JCSG derived values for Air Force T&E activities to support the intra-Air Force analysis and development of Military Value (MV). However, the JCSG values were not available in time to support the AF process for development of MV's for delivery to the JCSGs. To ensure consistency with the T&E JCSG analysis process, the Air Force used the same certified data and general methodology as the T&E JCSG to determine workload, capacity and Functional Values (FV) for AF T&E activities. These data formed the basis for the intra-Air Force analysis.

The Air Force core T&E requirements to support the Air Force mission were separately determined by AF/TE and provided as inputs, along with a set of Guiding Principles (Figures 6-8). A capability and capacity analysis was then performed to identify which core T&E capabilities needed to be retained and to identify opportunities for further realignment/consolidation within the Air Force. The results of this analysis helped define T&E capabilities available for cross-servicing, to be combined with the jointly developed T&E JCSG alternatives, and capacity available to cross-service other MilDeps using Air Force T&E core capabilities.

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## AF Core T&E Requirements

**Must Support AF Core Mission**

- Air Warfare is Fundamental Part of AF Mission and Vision
  - "To Defend the United States through Control and Exploitation of Air and Space"
  - "Air Force People Building the World's Most Respected Air and Space Force...Global Power and Reach for America"
- Air Warfare is Broad in Space and Time
  - Drives Unique Equipage Requirements

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Figure 6

Air Warfare is a fundamental part of the AF mission and vision... "Global Power and Reach for America". It is offensive in nature and broad in spatial and temporal domains in its application. As such, it drives unique equipage requirements, which makes it essential that the Air Force retain its core T&E capabilities to support the integrated development and acquisition of Air Armament/Weapons and Air Vehicle platforms to support its warfighters.

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## AF Core T&E Requirements

**Must Support Acquisition and Warfighter's Needs**

- T&E is Fundamental Part of Acquisition Process for Developing Unique Equipment for AF
    - Is It Designed Properly?
    - Does it Work?
    - Is It Effective?
- Requires Capability to Support Acquisition/Test Process and to Demonstrate Capability of USAF Fixed-Wing Aircraft/Weapons to
    - Reach Target (Air Vehicle T&E)
    - Survive Against Land & Air Threats (EC T&E)
    - Destroy Targets (Armaments/Weapons T&E)
    - Perform in Realistic Environments Representative of World-Wide Theaters of Operation

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Figure 7

T&E is fundamental to the acquisition process and key to addressing these three fundamental questions. If design science were perfect, one would not have to rely on T&E nearly as much. Although significant progress has been made in recent times to reduce the amount of flight testing, and rely more on modeling and simulation in ground facilities, retention of the minimum T&E infrastructure to support the test process, and in turn the acquisition process, will continue to be crucial for the near future.

To support the AF primary mission, core T&E capabilities for Air Vehicles, Armament/Weapons, and Electronic Combat must be retained to evaluate and demonstrate the capability of Air Force integrated fixed-wing aircraft/weapon systems to reach and destroy the target, and to safely return.

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## AF Core T&E Requirements

### Guiding Principles

- Retain Irreplaceable Natural Resources Needed to Test Current and Future Weapon Systems in Realistic Environments
  - Adequate Air/Land/Sea Space
  - Topography and Climate Representative of Plausible Theaters of Operation
  - Long Term Viability of Ranges (i.e., Encroachment and Environmental Considerations)
- Collocate Core T&E Capabilities to Support Test Process at Open Air Ranges in order to Minimize Number of T&E Sites and Leverage T&E Resources
  - Retain Core Capabilities at Other Sites Only When Geographically Constrained, Economically Prohibitive to Move, or Needed to Support Workload

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Figure 8

These guiding principles were issued by AF/TE to guide the analysis of the AF T&E infrastructure so as to ensure that irreplaceable natural resources and core T&E capabilities are retained to support T&E of current and future AF weapon systems in realistic environments (i.e. representative of plausible theaters of operation, to include the required diversity of climate and topography). Although various environments can be simulated in ground facilities, thus reducing the amount of flight testing in open-air ranges, it is recognized that the final T&E must be conducted in OARs to demonstrate weapon effectiveness and operational suitability to the warfighter. Better that this be done during peace-time on ranges replicating operational environments than during live conflicts.

Of critical importance is to ensure that adequate air, land, and sea space are retained to support such testing, particularly Armaments/Weapons testing with live warheads which require controlled air, land, and sea space. Once DoD gives up such critical resources, one can expect that they would be extremely difficult to recoup.

Also important is the long-term viability of ranges due to environmental impacts and encroachment, not just today, but for the foreseeable future. Encroachment concerns include population growth and the commensurate increase in air, land and sea traffic routes through DoD air, land, and sea space.

To minimize the number of sites, and thus real estate and costs required to support T&E, requires the collocation of as many test facilities as possible at open-air ranges (OARs). In addition, by retaining core T&E capabilities at other sites only when they are constrained to the site geographically, not cost effective to move, or required to support workload, the minimum T&E infrastructure and minimum excess capacity achievable are retained.

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## Capacity and Capability Analysis
### Overall Approach

- Determine AF Core T&E Capabilities Based On Air Force Primary Mission Requirements
  - Capability and Capacity Available for Cross-Servicing
- Identify Intra-AF Realignment Candidates for Further Consolidation of AF Core T&E Capabilities
- Identify Potential Candidates for AF Realignment Based on Potential Outcome of Base/Installation Analysis
  - Most Cost Effective Option

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These are the steps followed in conducting the capacity and capability analysis.

The first step led to the identification of capability and capacity available for cross-servicing.

The second step identified opportunities for further consolidation of Air Force core T&E capabilities (e.g., where projected workload could not support more than one facility in the same Test Facility Category).

The last step brought in the results of the Air Force base installation analysis to identify T&E facilities located at other installations that might be potential candidates for realignment as a result of the AF base installation analysis.

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# Capacity and Capability Analysis

## Capability Assessment

| T&E Function | AFFTC @ Edwards | AFFTC @ UTTR | AFDTC @ Eglin | AFDTC @ Holloman | 475 WEG @ Tyndall | AEDC @ Arnold | REDCAP @ Buffalo | AFEWES @ Ft Worth |
|---|---|---|---|---|---|---|---|---|
| Air Vehicle | F | | P | P | P | P | | |
| Armaments/ Weapons | | $\boxed{P}$ | F | P | P | P | | |
| Electronic Combat | $\boxed{P}$ | | $\boxed{P}$ | P | | | $\boxed{P}$ | $\boxed{P}$ |

F = Full Capability to Support All Six Test Facility Categories of the Acquisition/Test Process
P = Partial Capability
□ = Intra-AF Realignment/Consolidation Opportunities
○ = Geographically Constrained or Not Cost Effective to Move

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Whereas Air Vehicle and Armament/Weapons are already collocated at sites with the full capability to support the test process, AF electronic combat test facilities are geographically dispersed with no activity possessing full capability to support all six test facility categories (TFC). As a result, unnecessary duplication, competition for resources, and significant excess capacity exists, particularly in open air ranges (OAR) and installed systems test facilities (ISTF), for EC.

Primary participants in options to reduce EC excess capacity include AFFTC Edwards (ISTF), AFDTC AFEWES (HITL), AFDTC REDCAP (HITL), AFDTC Eglin (OAR and ISTF), and the Nellis AFB Range Complex (OAR). The latter was designated by the JCSG as the primary EC OAR receiver site, for DoD (i.e., it would be filled to capacity before moving OAR EC workload into any other site). Based on the certified data, it has the capacity to accept almost all of the workload from Eglin's Electromagnetic Test Environment (EMTE). HITL capabilities at AFEWES and REDCAP could be collocated with an EC ISTF to provide both better capabilities and lower costs. EC T&E capabilities at AFDTC Holloman are one of a kind and would not be cost effective to move. In addition to the EC realignment opportunities, one additional realignment opportunity for Armament/Weapons involving AFFTC (UTTR) was identified.

Core T&E capabilities at other sites that are geographically constrained or cost prohibitive to move include specialized facilities such as the climatic chamber at AFDTC (Eglin), wind tunnels and propulsion facilities at AEDC (Arnold), and inertial guidance and RCS measurements at AFDTC (Holloman).

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## AF Realignments & Consolidations
### Intra-AF Candidates

- Air Vehicle
  - None
- Armaments/Weapons
  - AFFTC (UTTR) Capabilities
- Electronic Combat
  - REDCAP (Buffalo) and AFEWES (Ft Worth) Hardware-in-the-Loop Facilities/Workload
  - AFDTC/EMTE (Eglin) Open-Air Range Facilities/Workload

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There are no further realignments possible within the Air Force for Air Vehicle T&E. Although the Radar Test Facility at the 475 WEG (Tyndall) was identified as a potential candidate by the T&E JCSG, it would not be cost effective to move unless it was part of a larger realignment or closure.

Since only 18% of the AFFTC (UTTR) workload is involved in T&E, and most of this T&E workload can be accomplished with core T&E capabilities at AFFTC (Edwards) and AFDTC (Eglin), AFFTC (UTTR) was identified as a realignment candidate by the AF.

There are three EC candidates for intra-Air Force realignments and consolidation: (1) AFDTC REDCAP, a HITL capability located at contractor's facility in Buffalo, NY; (2) AFDTC AFEWES, a HITL capability located in Air Force Plant 4, Ft Worth, TX; and (3) the Electromagnetic Test Environment (EMTE) OAR at AFDTC Eglin.



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# Armament/Weapons Realignment
## AFFTC (UTTR)

- Realign UTTR from AFMC T&E Range to ACC Training Range
  - Retain Minimum Capability to Support Training Requirements and Large Footprint Weapons T&E (e.g., Cruise Missile)
    - Critical Air/Land Space
    - MobileT&E Instrumentation/Support
  - Transfer Workload to AFDTC (Eglin) and AFFTC (Edwards)
  - Downsize Personnel to Satisfy New Requirements
  - Dispose of Remaining Equipment/Instrumentation
- Rationale
  - 82% of Current Missions are Training (Only 18% T&E)
  - Most of Current T&E Can Be Accomplished With Existing Core T&E Capabilities (AFDTC and AFFTC)
  - Requirement to Retain Air/Land Space

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This candidate involves the realignment of UTTR from Headquarters Air Force Materiel Command (HQ AFMC) to Headquarters Air Combat Command (HQ ACC). Currently, 82% of the missions are in support of ACC training, and only 18% of the missions are in support of test and evaluation (T&E), primarily operational test and evaluation (OT&E). Development test and evaluation (DT&E) missions make up less than 0.5% of the overall UTTR missions. The critical air and land space would be retained to predominately support training, and would be available for long-range, over-land air-to-surface tests which require the topographical features of UTTR.

Minimal test support would be retained at UTTR for cruise missiles, such as ALCM, ACM, and C-ALCM, unmanned air vehicles (UAV's), and large footprint air-to-surface Weapon System Evaluation Program (WSEP) tests. Other workload would be transferred to Air Force core T&E capabilities at Air Force Development Test Center (AFDTC) Eglin AFB FL and Air Force Flight Test Center (AFFTC) Edwards AFB CA. UTTR personnel resources would be downsized to align with the new (downscoped) requirements and would be transferred from HQ AFMC to HQ ACC.

All UTTR target areas which duplicate core T&E capabilities at AFDTC Eglin or AFFTC Edwards would be mothballed, and unnecessary equipment and instrumentation would be excessed. Remaining target areas, as well as mission control, communications, tracking, etc. assets, would be transferred from HQ AFMC to HQ ACC.

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# Criteria IV & V

**AFFTC (UTTR) Realignment**

| 1-Time Cost | 20 YR NPV* | Steady State Savings | ROI (Years) | Gov't Pers Savings |
|---|---|---|---|---|
| $3.2M | ($179.9M) | $12.4M | 0 | 104 |

* ( ) Indicate Savings

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$3.2 M is the 1-Time cost of the move and includes items such as moving, mothballing equipment, and termination costs; ($179.9M) (NPV in 2015) is the total net cost savings 20 years after start of BRAC.

$12.4M is the continuing net savings per year starting in 2002. This figure is derived from the total of yearly costs and yearly savings for factors such as military and civilian salary costs/savings and O&M or maintenance costs/savings for those areas changed by the BRAC option.

0 (ROI Year) is the number of years required to break even. This calculates the number of years from the initial BRAC cost action that it takes to achieve a return or payback on the initial cost or investment. ROI is measured in years from the start of any cost actions (FY96 for this case) and any ROI achieved in the first year of BRAC cost actions would be calculated as an Immediate or 0 year return.

104 (Personnel Savings) is the number of government personnel eliminated from the current operation as a result of the realignment. This is a resultant of the delta between the current manning and the manning estimated to be required as a result of the realignment.

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## Electronic Combat (EC) Realignment
## REDCAP/AFEWES/AFDTC (EMTE)

- Realign REDCAP &AFEWES Hardware-In-The-Loop (HITL) and AFDTC/EMTE Open-Air-Range (OAR) Facilities
  - Move Workload and Required Equipment from REDCAP and AFEWES to AFFTC/BAF (Edwards) and AFDTC/GWEF (Eglin) Facilities
  - Move Required Threat Systems from AFDTC/EMTE (Eglin) to Nellis Complex
  - Disestablish REDCAP, AFEWES, and Dispose of Remaining Equipment
  - Retain Threat Emitters at AFDTC (Eglin) to Support AFSOC, AWC, and Armaments/Weapons T&E
- Rationale
  - Projected Workload/Requirement at REDCAP and AFEWES is 10% and 28% of their Respective Capacities
  - AF EC OAR Workload/Requirement Can Be Satisfied with One versus Two Ranges
  - Available Capacity at Existing Core AF T&E Activities to Absorb Workload

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There are three proposed intra-AF realignments targeted to reduce excess capacity in those TFCs having more than one facility and whose capacity greatly exceeds projected workload. Additionally, those TFCs offering the largest potential payback were reviewed first.

The two TFCs that offer the most payback in terms of internal AF realignments are HITLs and OARs

AFEWES and REDCAP are both EC HITLs which, although not duplicative in terms of specific threat simulators, share much the same basic infrastructure. Additionally, this infrastructure (instrumentation, environment and scenario generation capabilities, etc.) is shared with ISTFs.

Low projected HITL workload combined with excess capacity in ISTFs, offers the opportunity to merge these facilities from the two different TFCs into one integrated, efficient, and useful facility.

This would allow expensive hybrid threat simulators to be utilized for testing both federated and integrated avionics systems, including EW functions of fully integrated avionics suites

The Avionics Test and Integration Complex at AFFTC Edwards would be the optimum location for consolidating EC HITL and ISTF test capabilities since the ISTF capability to house any aircraft already exists there; also, such EC testing would then be collocated with closely associated avionics testing and near the premier EC OAR (i.e. Nellis Complex).

IR laboratory workload from AFEWES would be relocated to the Guided Weapons Evolution Facility (GWEF) at AFDTC Eglin, since that capability already exists there.

The largest potential savings comes from realigning EC OAR workload from AFDTC Eglin to the Nellis Range Complex

The AF currently operates and manages two EC OAR, both of which are appropriately 50 percent utilized.

The OAR capabilities existing at Eglin AFB are 85 percent duplicative of those existing at the Nellis Complex. This proposal would transfer only the small portion of Eglin EC OAR capabilities needed to the Nellis Complex. The remainder of Eglin's threat simulators would be surplused on location, with some of the threat emitters retained to support Armament/Weapons EC integration testing and training.

This consolidation would provide a better test capability in addition to saving significant I&M and O&M funds

This would also improve the capability to employ tactical threat simulators in optimum numbers to present realistic signal and pulse densities, especially for OT&E.

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## Criteria IV & V

### REDCAP/AFEWES/AFDTC (EMTE) Realignment

| | 1-Time Cost | 20 YR NPV* | Steady State Savings | ROI (Years) | Gov't Pers Savings |
|---|---|---|---|---|---|
| REDCAP | $1.7M | ($11.0M) | $0.9M | 1 yr | 2 |
| AFEWES | $5.8M | ($5.8M) | $0.8M | 7 yrs | 3 |
| EMTE | $2.2M | ($31.4M) | $2.6M | 1 yr | 0 |

* ( ) Indicate Savings

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### REDCAP

$1.7M is the 1-Time Cost of realigning REDCAP to Edwards. This cost primarily includes cost of tear-down, shipment, set-up and calibration of the equipment involved in the transfer. ($11.0M) [Net Present Value (NPV) 2015] is the total net savings 20 years after the start of BRAC and is composed of initial net costs/savings and the summation of yearly cost savings starting in 2002. $0.9M is the continuing net savings per year beginning in 2002. This figure reflects primarily the salary savings associated with the realignment.

1 (ROI YEAR) is the number of years required after the start of the first cost action for the total net savings of the option to offset the initial net costs. 2 (Personnel Savings) is the number of government personnel eliminated as a result of this option.

### AFEWES

$5.8M is the 1-Time Cost of realigning AFEWES to Edwards. This primarily includes cost of tear-down, shipment, set-up and calibration of the equipment involved in the transfer. ($5.8M) (NPV 2015) is the total net savings 20 years after the start of BRAC and is composed of initial net costs/savings and the summation of yearly cost savings starting in 2002. $0.8M is the continuing net savings per year beginning in 2002. This figure reflects primarily the salary savings associated with the realignment.

7 (ROI YEAR) is the number of years required after the start of the first cost action for the total savings of the option to offset the initial costs. 3 (Personnel Savings) is the number of government personnel eliminated as a result of this option.

**EMTE**

$2.2M is the 1-Time Cost of realigning the EMTE. This cost primarily includes cost of tear-down, shipment, set-up and calibration of the equipment involved in the transfer. ($31.4M) (NPV 2015) is the total net savings 20 years after the start of BRAC and is composed of initial net costs/savings and the summation of yearly cost savings starting in 2002. $2.6M is the continuing net savings per year beginning in 2002. This figure reflects primarily the O&M range contractor salary savings associated with the realignment.

1 (ROI YEAR) is the number of years required after the start of the first cost action for the total net savings of the option to offset any initial net costs. 0 (Personnel Savings) reflects that no personnel were eliminated as a result of this option.

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## *Realignments & Consolidations
**Potential Impacts on T&E**

- Air Vehicle
  - 475 WEG (Tyndall) Radar Test Facility
- Armaments/Weapons
  - 475 WEG (Tyndall) Target Capabilities
  - AFDTC (Holloman) Capabilities
    - Inertial Guidance, RCS Measurement and High Speed Test Track
    - Flight Operations to Support Air Weapons Testing at WSMR (White Sands)
- Electronic Combat
  - None

* Dependent on Air Force Decisions (Cost Effective Only if Required by Closure of Host Base)

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Six T&E capabilities/facilities are dependent on AF decisions regarding their host base and could be affected:

a) 475 WEG (Tyndall AFB, FL) Radar Test Facility -
The Radar Test Facility is an Air Vehicle T&E capability owned by the operational Air Combat Command which is not duplicated elsewhere, and is primarily weapon system unique to the F-15/ F-16s and as such, should have been excluded from the BRAC analysis.

b) 475 WEG (Tyndall AFB, FL) Target Capabilities -
The full-scale and sub-scale target capabilities at Tyndall AFB, FL are leveraged by AFDTC Eglin to support Armament/Weapons air-to-air and surface-to-air open air range testing.

c) AFDTC (Holloman AFB, NM) Central Inertial Guidance Test Facility (CIGTF) -
The inertial guidance capabilities are geographically constrained, support many DoD users, and are costly to move.

d) AFDTC (Holloman AFB, NM) RCS Measurement Capability (RATSCAT/RAMS)-
The RCS measurement capabilities are geographically constrained and support DoD users.

e) AFDTC (Holloman AFB, NM) High Speed Test Track (HSTT) -
The track testing is geographically constrained and supports DoD users.

f) AFDTC (Holloman AFB, NM) Flight Operations-
The fixed-wing aircraft flight operations and full-scale target capabilities which support White Sands Missile Range (WSMR) air weapons testing are provided by AFDTC and the 475 WEG out of Holloman AFB. Loss of these flight operations would preclude WSMR's ability to conduct air-to-air testing and severely reduce WSMR's capability to conduct surface-to-air testing.

In most cases, realigning these facilities would be cost effective only if required by closure of the host base, which is dependent on the AF BRAC decisions.

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## T&E JCSG Alternatives

**Overview**

- 13 Alternatives (14 Realignment Opportunities) Jointly Developed by T&E JCSG Evaluated by AF
  - 6 Air Vehicle
  - 5 Armament/Weapons
  - 3 Electronic Combat
- AF Activities Scored Highest Functional Value in Each T&E Functional Area
  - Selected as Preferred Receiver by Optimization Model

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The AF evaluated all T&E JCSG Alternatives where it was identified as either a potential receiver or potential loser.

Based on the T&E JCSG approved results, AF T&E Activities scored the highest FV in each of the three T&E Functional Areas (AV, A/W, & EC). Since the T&E JCSG approved optimization model used workload-weighted FV in assigning workload, AF T&E Activities were the preferred receiver sites for each T&E Functional Area.

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# T&E JCSG Alternatives

## Functional Values

**Air Vehicles**

| Activity | JCSG FV |
|---|---|
| AFFTC- Edwards | 85 |
| NAWC - Pax River | 81 |
| NAWC - Pt Mugu | 69 |
| AFDTC - Eglin | 56 |
| 476WEG - Tyndall | 49 |
| UTTR - Hill | 46 |
| AQTD - Edwards | 46 |
| EPG - Ft Huachuca | 44 |
| NAWC - China Lake | 43 |
| YPG - Yuma | 35 |
| ATTC - Ft Rucker | 34 |
| AFDTC - Holloman | 33 |
| NSWC - Dahlgren | 25 |
| NAWC - Indianapolis | 19 |
| AEDC - Arnold | 18 |
| NAWC - Warminster | 14 |

**Armaments/Weapons**

| Activity | JCSG FV |
|---|---|
| AFDTC - Eglin | 82 |
| NAWC - Pt Mugu | 77 |
| NAWC - Pax River | 57 |
| NAWC - China Lake | 57 |
| WSMR | 50 |
| AFDTC - Holloman | 30 |
| YPG - Yuma | 29 |
| NAWC - WSMR | 25 |
| RTTC - Redstone | 21 |
| NSWC - Dahlgren | 17 |
| AEDC - Arnold | 16 |
| NSWC - Indian Head | 14 |
| NSWC - Crane | 13 |

**Electronic Combat**

| Activity | JCSG FV |
|---|---|
| AFDTC - Eglin | 65 |
| NAWC - Pt Mugu | 58 |
| NAWC - Pax River | 53 |
| AFFTC- Edwards | 52 |
| NAWC - China Lake | 47 |
| EPG - Ft Huachuca | 47 |
| AFDTC - Holloman | 29 |
| NSWC - Crane | 17 |
| AFEWES - Ft Worth | 17 |
| REDCAP - Buffalo | 15 |

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This chart shows the T&E functional values (FV) developed by the T&E JCSG.

A total of 16 DoD activities are involved in air vehicle test and evaluation. The JCSG-developed functional values for these activities range from a high of 85 for AFFTC Edwards to a low of 14 for NAWC Warminster.

A total of 13 DoD activities are involved in armaments/weapons test and evaluation. The JCSG-developed functional values for these activities range from a high of 82 for AFDTC Eglin to a low of 13 for NSWC Crane.

A total of 10 DoD activities are involved in electronic combat test and evaluation. The JCSG-developed functional values for these activities range from a high of 65 for AFDTC Eglin to a low of 15 for AFDTC REDCAP, as shown on this chart.

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# T&E JCSG
## Alternatives
### Air Vehicle

| T&E JCSG Alternative | Realignment Opportunity | Capability/ Capacity Fit | Recommendation |
|---|---|---|---|
| TE-1 (AV) | Ft Rucker Rotary Wing | Yes | Cross-Service Army at Edwards |
| TE-2 (AV) | AQTD Edwards Rotary Wing | Yes | Retain at Edwards |
| TE-3 (AV) | Indianapolis Measurement/Integration | No | Do Not Cross-Service |
| TE-4 (AV) | Dahlgren Measurements | No | (No AF Involvement) |
| TE-5 (AV) | Warminster Digital Sims | No | (No AF Involvement) |
| TE-6 (AV) | Tyndall Radar Test Facility | Partial | Intra-AF Realignment |

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The Air Vehicle T&E Joint Cross Service Working Group generated six alternatives for realigning the six "non-core" activities (eight test facilities). Each alternative listed, as potential gaining sites, all "core" activities with any test facility in the same test facility category as that proposed for realignment. Two of these alternatives (TE-4 (AV) and TE-5 (AV)) involved only Navy activities and therefore were not considered during the intra-Air Force analysis.

Alternative TE-1(AV) recommended realigning the open air range test work from the Army's Ft Rucker test activity. The most likely gaining activity was listed as Yuma Proving Ground because of the Army's stated intention of consolidating all rotary wing testing at Yuma. The Air Force offered to cross-service this workload by combining it with the Army's existing AQTD tenant facilities at Edwards AFB. There is sufficient test capacity and infrastructure at AQTD (Edwards) to absorb this workload without any MILCON expenditures, as is currently planned for Yuma.

Alternative TE-2 (AV) recommended realigning the air vehicle test work at AQTD to a "core" activity with Yuma, again, identified as the "most likely" gaining activity. Exercising this option would undo the current cross-servicing arrangement between the Air Force and the Army. The Air Force recommended continuing to cross-service the Army at AFFTC (Edwards).

Alternative TE-3 (AV) recommended realigning workload from an environmental measurement facility and two integration labs at NAWC Indianapolis. The measurement facility performs a function not duplicated in the Air Force, and the integration labs conduct testing on mostly Navy unique avionics systems. Therefore the Air Force recommendation was not to offer to cross-service this work.

Alternative TE-6 (AV) recommended realigning the Radar Test Facility at Tyndall AFB. For reasons of cost, and impact on the operational user, which owns the facility, the Air Force recommendation was not to realign the facility unless necessitated by closure of the host base.

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# T&E JCSG
## Alternatives
### Armaments/Weapons

| T&E JCSG Alternative | Realignment Opportunity | Capability/ Capacity Fit | Recommendation |
|---|---|---|---|
| TE-1 (AW) | Crane Ordance Measurements | Yes | Cross-Service Navy at Eglin |
| TE-2 (AW) | Dahlgren Ordance Measurements | Yes | Cross-Service Navy at Eglin |
| TE-3 (AW) | Indian Head Propulsion | Partial | Do Not Cross-Service Navy |
| TE-4 (AW) | Redstone Open Air Range | Yes | Cross-Service Army at Eglin |
| | Redstone Component Testing | Partial | Do Not Cross-Service Army |

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The Armament/Weapons T&E Joint Cross Service Working Group generated four alternatives for realigning the four "non-core" Armament/Weapons T&E activities. These "non-core" alternatives realign eleven (11) test facilities. Each alternative listed as potential gaining sites all "core" activities with any test facility in the same test facility category or subcategory as that proposed for realignment.

Alternative TE-1(AW) recommended realigning the Armament/Weapons T&E measurement facility work from the Naval Surface Warfare Center at Crane. Potential gaining activities for the measurement facility environmental work were Navy and Army activities. Potential gaining activities for the measurement facility guns/ordnance work were AFDTC Eglin and NAWC China Lake. The Air Force offered to cross-service this workload, since there is sufficient capability and capacity at AFDTC Eglin to absorb this workload.

Alternative TE-2 (AW) recommended realigning the Armament/Weapons T&E measurement facility work from the Naval Surface Warfare Center at Dahlgren. Potential gaining activities for the measurement facility electromagnetic work were Navy and Army activities. Potential gaining activities for the measurement facility guns/ordnance work were AFDTC Eglin and NAWC China Lake. The Air Force offered to cross-service this workload, since there is sufficient capability and capacity at AFDTC to absorb this workload.

Alternative TE-3(AW) recommended realigning the Armament/Weapons T&E measurement facility work from the Naval Surface Warfare Center at Indian Head. Potential gaining activities for the measurement facility environmental work were Navy and Army activities. Potential gaining activities for the measurement facility propulsion work were AEDC Arnold and NAWC China Lake. The Air Force did not offer to cross-service the Navy, since Air Force analysis indicated only a partial capability match with AEDC Arnold facilities.

Alternative TE-4(AW) recommended realigning the Armament/Weapons T&E measurement facility and open air range work from the Army's Redstone Technical Test Center. Potential gaining activities for the measurement facility environmental work were Army and Navy activities. Potential gaining activities for the measurement facility guidance work were AFDTC Eglin, AFDTC Holloman, NAWC China Lake, and NAWC Pt Mugu. The Air Force did not offer to cross-service the Army measurement facility work, since Air Force analysis indicated only a partial capability match with AFDTC Eglin and Holloman facilities. Potential gaining activities for the Redstone open air range work were AFDTC Eglin, Navy activities, and Army activities. The Air Force offered to cross-service the Army, since Air Force analysis indicated both capability and capacity were available at AFDTC Eglin to absorb the Army workload.

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# T&E JCSG
## Alternatives
### Electronic Combat

| | T&E JCSG Alternative | Realignment Opportunity | Capability/ Capacity Fit | Recommendation |
|---|---|---|---|---|
| * | TE-1 (EC) | REDCAP, Buffalo NY | Partial | Intra-AF Realignment |
| * | TE-2 (EC) | AFEWES, Ft Worth TX | Partial | Intra-AF Realignment |
| | TE-3 (EC) | Crane Electromagnetics | No | (No AF Involvement) |

* "Requests for Data" Also Sent to the Navy

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The electronic combat T&E Joint Cross Service Working Group generated alternatives for realigning the three "non-core" activities (one test facility each). Each alternative lists, as potential gaining sites, "core" activities with test facilities compatible with the proposed realignment One of these alternatives [TE-3 (EC)] involves only Navy and Army activities and therefore was not considered during intra-Air Force analysis.

Alternative TE-1 (EC) recommends realigning hardware-in-the-loop (HITL) work from the Air Force's Real-Time Digitally Controlled Analyzer/Processor (REDCAP) test activity. The most likely gaining activity identified by the T&E JCSG is listed as Edwards AFB because of the benefits of collocating HITL and installed systems test facility (ISTF) test capabilities. The Air Force analyzed data from Edwards AFB, Patuxent River NAS, and Pt Mugu NAS to determine the potential economic benefits of consolidating to these activities.

Alternative TE-2 (EC) recommends realigning HITL work from the Air Force Electronic Warfare Evaluation Simulator (AFEWES) test activity. The most likely gaining activity identified by the T&E JCSG is again listed as Edwards AFB to take advantage of benefits associated with collocating HITL and ISTF test capabilities. In this case, also, the Air Force analyzed data regarding Edwards AFB, Patuxent River NAS, and Pt Mugu NAS to determine the most economically beneficial gaining activity.

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# T&E JCSG Alternatives
## Recap

- 14 Realignment Opportunities
  - 11 Identify AF As Potential Receiver
  - 3 Do Not Involve AF
- For 11 Realignments with AF As Potential Receiver
  - 3 Recommended for Intra-AF Realignments
    - 2 Evaluated for Cross-Servicing (w/Navy)
  - 5 Recommended for AF to Cross-Service
    - Capacity/Capability Fit (Beneficial to AF/DoD)
  - 3 Not Recommended for AF to Cross-Service
    - Partial to No Capability Fit (No Benefit to AF/DoD)
- Above Consistent with AF Core T&E Capabilities
  - Appear to have no TOA or End Strength Implications

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Only three of the 14 T&E JCSG realignments involved Air Force facilities as the potential losing activity. For these three realignments, the Air Force was also listed as the potential receiver activity, along with the Navy.

The Air Force evaluated two of these three realignments for cross-servicing with the Navy and compared the results with intra-Air Force realignments. The third realignment (Tyndall Radar Test Facility) was considered for intra-Air Force realignment only.

In five of the realignment opportunities involving the Air Force as the potential receiver site, there was a complete capability match and available capacity to cross-service the other MilDeps. In the other cases there was not such a match. In these cases, there was a better capability/capacity match with the other potential receiver activities identified by the T&E JCSG, and thus greater potential for cost/savings than could be realized by realigning to AF receiver activities.

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## T&E JCSG Alternatives

### Status

- AF (as Losing Service) Issued "Requests for Data" for TE-1 (EC)/REDCAP and TE-2 (EC)/AFEWES to Navy and Evaluated Response (Not Cost-Effective)
  - No Request Made for TE-6 (AV)/Tyndall Radar Test Facility Since Predominantly AF Unique to F-15 & F-16
- Army Has Requested Data for All 4 of its T&E JCSG Alternatives (As Losing Service)
  - AF has Responded and Offered to Cross-Service 3 of 4 Opportunities Within Available AF Capability/Capacity
- Navy Has Not Requested Data for Any of its 7 T&E JCSG Alternatives to Date (As Losing Service)

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In accordance with the procedures defined by the BRAC Steering Group for conducting COBRA analyses, the Air Force issued "Requests for Data" for two of the three alternatives where the Air Force was identified as the potential losing service. For the remaining alternative, the Radar Test Facility (Tyndall), the Navy (Pax River) was listed as one of four potential receiver sites (the other three were Air Force sites). Since the Radar Test Facility is predominately unique to the Air Force F-15/F-16 and required by the collocated operational users to support their mission, no request to the Navy was made. Instead, the Air Force evaluated it as part of its intra-Air Force analysis.

The Air Force responded to the Army by offering to cross-service the Army on three of the four alternatives where the Army was listed as a potential losing service, and there was a capability/capacity match with Air Force core T&E infrastructure.

Since the Navy did not request data for any of the seven alternatives listing them as the potential losing service, and the Air Force as a potential receiver, the Air Force was unable to respond. The Air Force did offer in its response to the T&E JCSG (Ref 2) and MilDep T&E Principals on the T&E JCSG (Ref 8) that there were capability/capacity matches and that the Air Force was willing to cross-service Navy, but no response was received.

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## Criteria IV & V

**Evaluation of TE-1 (EC)/REDCAP & TE-2 (EC)/AFEWES**

| T&E JCSG Alternative | Potential Receiver Sites | 1-Time Cost ($M) | 20 YR NPV* ($M) | Steady State Savings ($M) | ROI (Years) | Gov't Pers Savings |
|---|---|---|---|---|---|---|
| TE-1 (EC)/REDCAP | | | | | | |
| | ** EDWARDS | 1.7 | (11.0) | 0.9 | 1 | 2 |
| | PAX | 3.9 | (7.3) | 0.8 | 4 | 0 |
| | PT MUGU | 4.8 | 2.7 | (0.1) | 100+ | 2 |
| TE-2 (EC)/AFEWES | | | | | | |
| | ** EDWARDS | 5.8 | (5.8) | 0.8 | 7 | 3 |
| | PAX | 6.1 | (0.9) | 0.5 | 14 | 0 |
| | PT MUGU | 10.7 | 6.5 | 0.3 | 100+ | 2 |

** Most Cost-Effective Option
* ( ) Indicate Savings

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### REDCAP and AFEWES

A previous chart (#29) provided the AFDTC (AFEWES) and AFDTC (REDCAP) COBRA cost options for the Air Force intra-service option. This option involved movement of both the AFDTC (REDCAP) capability from Buffalo NY and the AFDTC (AFEWES) capability from Ft Worth TX to AFFTC (Edwards).

This chart compares the AF option to the Navy options of moving the capability individually to NAWC (Pt Mugu) or to NAWC (Patuxent River) and shows that consolidation at Edwards is more cost effective. These options were analyzed in much the same manner as the AFFTC (Edwards) option.

The personnel eliminations requested by the Navy were used as a percentage and applied to the $1.2M O&M cost for each facility. The equipment moving costs were based on using a percentage of equipment to be transferred times the cost of moving all equipment. The NAWC (Pt Mugu) options resulted in payback beyond 100 years. This was a direct result of the NAWC (Pt Mugu) requirement for rehab of existing facilities, the requirement for shipping the majority of the equipment from both facilities, and the need for more contractor personnel for operations.

The NAWC (Pax River) option was similar in many respects to the AFFTC (Edwards) option with the exception of the need for equipment integration costs as well as the need for more government and contractor personnel.

The Navy provided additional inappropriate savings in their data response that were not considered in this analysis. These items involved savings for equipment that was not being shipped (inappropriate since no cost was being offset) and for continued personnel savings that are automatically considered by the COBRA program.

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## Part I: Summary

- AF Core T&E Capabilities/Workload to Support AF Mission Already Consolidated for Air Vehicles (AFFTC, Edwards AFB) and Armaments/Weapons (AFDTC, Eglin AFB) to Extent Possible with Few Exceptions
  - Exceptions Addressed in Intra-AF Realignments
- AF Core T&E Capability/Workload for Electronic Combat Fragmented
  - Consolidation to Minimum Number of Activities/Sites Addressed in Intra-AF Realignments
  - Two T&E JCSG Cross-Servicing Opportunities Evaluated with Navy (i.e. REDCAP and AFEWES), But Not Cost-Effective
- Signficant Opportunities for Intra-Service Consolidation Exists Within Navy and Army
  - Presumably Will Be Addressed in their Intra-Service Analyses

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The Air Force core T&E capabilities for Air Vehicle and Armaments/Weapons are already consolidated at AFFTC (Edwards) and AFDTC (Eglin), respectively. The only remaining opportunity to further consolidate in these two functional areas, the realignment of AFFTC (UTTR), was evaluated and included in the recommended intra-AF realignments. These two sites have the full capability to support all six categories of the test process. The remaining specialized facilities providing core T&E capabilities are either geographically constrained or not cost-effective to move.

On the other hand, the AF core T&E capability for EC is fragmented at several different locations. Three realignments involving AFDTC (REDCAP), AFDTC (AFEWES), and AFDTC (Eglin) EC OAR were evaluated and included in the recommended intra-AF realignments. This resulted in the minimum number of AF sites possible to support EC T&E. Two of these realignments, AFDTC (REDCAP) and AFDTC (AFEWES), were also evaluated for cross-servicing by the Navy, but found not to be as cost-effective as the intra-AF realignments.

A comparison of the number of T&E activities by Service, as shown in the next chart, reveals significant opportunities in the Navy and Army for similar intra-Service consolidations.

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## Tri-Service T&E Activities

| T&E Functional Area | AF* | Navy | Army |
|---|---|---|---|
| AV | AFFTC, Edwards | NAWC, Pax River<br>NAWC, Pt Mugu<br>NAWC, Indianapolis<br>NAWC, China Lake<br>NAWC, Dahlgren<br>NAWC, Warminster | Yuma Proving Grounds<br>ATTC, Ft Rucker<br>AQTD, Edwards<br>EPG, Ft Huachuca |
| A/W | AFDTC, Eglin | NAWC, Pax River<br>NAWC-WD, China Lake<br>NAWC-WD, Pt Mugu<br>NAWC, WSMR<br>NSWC, Crane<br>NSWC, Dahlgren<br>NSWC, Indian Head | WSMR<br>YPG<br>RTTC, Redstone |
| EC | AFFTC, Edwards<br>Nellis Complex | NAWC-WD, China Lake<br>NAWC-AD, Pax River<br>NSWC, Crane<br>NAWC, Indianapolis<br>NAWC, Pt Mugu | WSMR<br>EPG, Ft Huachuca |
| DoD/ National Facilities | AEDC, Arnold<br>AFDTC, Holloman | | |

* After Intra-AF Realignments

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Based on the recommended intra-AF realignments, the AF will have consolidated its core T&E capabilities into the fewest possible T&E Activities/Sites to support the AF primary mission. The 475 WEG (Tyndall) is not shown since Tyndall is owned and operated by the operational Air Combat Command and its only test facility, the Radar Test Facility, is predominantly F-15/F-16 peculiar. Its other capabilities are all support facilities and were excluded as such by the T&E JCSG.

It is clear from this comparison that the other Services have significant opportunities for intra-Service consolidations.

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## Part I: Summary (cont'd)

- T&E JCSG Alternatives Integrated Into AF Analysis and Opportunities for Cross-Servicing Being Evaluated
  - 2 Requests to Navy to Cross-Service AF
  - 3 Offers By AF to Cross-Service Army
  - No Requests from Navy to Cross-Service
- Intra-AF Consolidations of Core T&E Capabilities Eliminates All Excess Capacity Linked to Infrastructure Savings
  - Remaining Excess Represents "Sunk Costs" and Is Capacity Available for Future Workload/Surge and Cross-Servicing
- AF Already Providing Significant Cross-Servicing Using AF Core T&E Capabilities
  - AFFTC (Edwards AFB)
  - AFDTC (Eglin AFB)
  - AEDC (Arnold AFB)

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In addition to integrating the T&E JCSG alternatives into the Air Force analysis, the Air Force evaluated the Navy's capabilities to cross-service the Air Force for two alternatives and offered to cross-service the Army for three other alternatives. Since no requests were received from the Navy for any of the alternatives where the Navy was the potential losing Service, there was no basis to evaluate the potential for Air Force to cross-service the Navy. Requests were received from the Army and responded to by the Air Force.

The Air Force went beyond the T&E JCSG alternatives by recommending additional intra-Air Force realignments, thus eliminating all Air Force excess capacity linked to infrastructure savings (i.e., the minimum number of facilities exist to satisfy the Air Force T&E capability and workload requirements), thus leveraging the remaining capacity available to support additional workload and cross-servicing.

As noted in the next chart, the Air Force is already providing significant cross-servicing to other services and agencies at its existing test centers.

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## AF Current Cross-Servicing

- AFFTC (Edwards AFB CA)
  - Army's Rotary Wing AQTD at Edwards
  - NASA Flight Operations
  - Space Shuttle
- AFDTC (Eglin AFB FL)
  - Army's Hellfire Test Complex
  - Joint AF/Army Munitions T&E ("Chicken Little")
- AFDTC (Holloman AFB NM)
  - Central Inertial Guidance Test Facility (CIGTF)
  - High Speed Test Track (HSTT)
  - Flight Operations and Full Scale Aerial Target Support for Army's WSMR
- AEDC (Arnold AFB TN)
  - Wind Tunnels and Propulsion Facilities

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Air Force core T&E capabilities are already used to a significant degree by other Services and Agencies. The Army currently leverages capabilities at AFFTC (Edwards) for rotary wing testing and AFDTC (Eglin) for Hellfire missile testing and joint evaluation of smart munitions (Project Chicken Little). Capabilities at AFDTC (Holloman) and AEDC (Arnold) involving inertial guidance, RCS measurements, high-speed sled track, wind tunnels, and propulsion facilities are already recognized centers of excellence supporting all of DoD. In addition, all flight operations and full-scale aerial targets support for the Army air-launched weapons T&E capability at WSMR are provided by AFDTC (Holloman).

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# Air Force BRAC '95 Analysis of T&E Infrastructure

Part II: Completion of JCSG Analysis Plan

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This section of the report summarizes the results obtained by completing the T&E JCSG analysis plan for "core" T&E activities, as originally intended and documented in Reference 4 (See Appendix B to this report for a copy).

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# Purpose

- Present Results of AF Analysis Based on Completion of T&E JCSG Analysis Plan
  - Identify Cross Servicing Opportunities Between T&E "Core" Activities for Each T&E Functional Area
  - Address T&E Co-Chairs Alternatives

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The primary purpose of this part is to identify cross-servicing opportunities between "core" T&E activities by completing the T&E JCSG analysis plan.

These results provide an analytical basis for addressing the T&E JCSG Co-Chair alternatives.

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## Part II: Outline

- Background
- T&E JCSG Analysis Process
- T&E Functional Analysis/Results
  - Electronic Combat
  - Air Vehicle
  - Armament/Weapons
- T&E JCSG Co-Chair Alternatives
- Cost Analysis
- Summary

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The background covers the events that led up to the Air Force's decision to complete the T&E JCSG analysis plan on its own.

The next section covers the T&E JCSG analysis process, as approved by the T&E JCSG and BRAC Steering Group, since it was used by the Air Force to complete the analysis.

The results obtained by completing the T&E JCSG analysis are presented for each of the T&E functional areas (AV, A/W, and EC).

These results are compared to the T&E JCSG Co-Chair alternatives, which involve "core" T&E activities but no T&E analysis to support the alternatives, to show which parts of their alternatives are supported by analysis of the certified data.

Where possible, estimated costs/savings are presented for realignment of T&E activities.

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## Background

- T&E JCSG Analysis Plan Was Not Completed IAW Approved Plan
  - "Core" Activities Not Analyzed for Realignments
  - Last Steps in Process Deferred to MILDEPs
- Jointly Developed T&E JCSG Alternatives Only Addressed "Non-Core" Activities
  - Movement of Workload/Capabilities Between "Core" Activities Not Allowed
  - Excess Capacity Among "Core" Activities Not Addressed
- T&E JCSG Co-Chairs Provided Additional Alternatives to Address "Core" Activities
  - Since No Analysis to justify Alternatives Provided, AF Did Not Respond
  - Led to AF Completing T&E JCSG Analysis Plan on its own to Provide Basis for Alternatives Addressing "Core" Activities

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These are the events that led to the Air Force's decision and rationale for completing the T&E JCSG analysis plan on its own. A major factor was the issuance of alternatives by the T&E Co-Chairs for "core" T&E activities with no supporting analysis to justify them. This was after the T&E JCSWG was precluded from realigning workload or capability between "core" T&E Activities during the joint development of the T&E JCSG alternatives for "non-core" T&E activities.

In addition, the last two steps in the T&E JCSG analysis process were deferred to the MILDEPs versus completing them jointly. Since these steps ("Technical and Operational Feasibility" and "Functional COBRA Analysis") are crucial to the development of viable alternatives, they were included in the AF analysis, to the extent possible given that there was no joint arena for completing them.

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## Background (Cont'd)

- Last Steps of Analysis Crucial to the Development of Viable Alternatives
  - Capacity/Capability Fits at Test Facility Level
  - Concept of Operations (CONOPS) Agreeable by Affected Services
  - T&E JCSG Policy Imperatives (i.e., Preserve DoD Capabilities to Satisfy Current/Future Test Requirements)
  - Cost Effective
- AF Has Completed T&E JCSG Analysis Plan at the "Test Facility" Level Using Certified Data
  - Addressed Realignments/Consolidations Between "Core" Activities

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The last two steps in the T&E JCSG analysis process are crucial to the development of viable alternatives (see Figure 5 and Appendix B for description of steps). Unless comparisons of capability and capacity are made at the Test Facility level, it is not possible to identify shortfalls that might drive upfront costs such as MILCON, as well as recurring costs associated with the number of personnel required to accomplish the workload. Similarly, costs can be significantly affected by the CONOPS, which has to be agreed to by all parties involved. In addition, it is crucial to ensure that any proposed realignment preserves the capability to satisfy DoD T&E requirements, and, most importantly, is cost effective.

These steps are included in the AF analysis presented therein, which addresses realignments/consolidations between "core" T&E activities.

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**T&E JCSG Analysis Plan**
**Overall Approach**

- Optimization Model Outputs From the T&E JCSG Approved Runs Used as Point of Departure
  - Analysis Conducted For Each Functional Area Separately (i.e., AV, A/W & EC) IAW Approved Process
  - Analysis Conducted at "Test Facility" Level
- Model Outputs for MAXSFV(MINSITES) Used to Assign Workload
  - Maximizes Workload Weighted Functional Value for the "MINSITES" Solution
  - Other Objective Function Runs Used to Establish Benchmarks and Validate MAXSFV(MINSITES) Solution
    - "MINSITES" Provides Fewest Sites that Can Accomodate Workload
    - "MINXCAP" Provides the Minimum Excess Capacity Possible Regardless of FV
    - "MINNMV" Assigns Workload Based on MV versus FV
    - "MAXSFV (W=0)" and "MAXSFV (W=95)" Vary Workload Weights Applied to FV to Assess Sensitivity

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The workload assignment output from the T&E JCSG approved optimization model runs was used as a point of departure for follow-on functional area analysis. Each functional area (AV, A/W, and EC) was analyzed separately at the "test facility" level versus the "activity" level. Facility capabilities were evaluated and compared against other facilities in the same test facility category/subcategory.

The workload assignments from the objective function MAXSFV (MINSITES) were used as the initial departure point. This objective function maximizes the workload weighted by functional value while constraining the number of sites to the minimum required to accommodate the projected workload. The MINSITES, MINXCAP, and MINNMV objective functions were used by the T&E JCSG to establish thresholds or benchmarks. The MINSITES solution provided the minimum number of sites which are required to accommodate the FY2001 projected workload. The MINXCAP solution provided the minimum excess capacity to which DoD could decrease and still accomodate the projected workload without regard to functional value. The MINNMV assigns workload to high military value sites without regard to functional value. The other MAXSFV objective functions vary the workload weights applied to functional value and were used to assess the sensitivity of workload weighting on workload assignments.

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## T&E JCSG Analysis Plan
## Overall Approach (Cont'd)

- Capability and Capacity Mismatches Identified at the "Test Facility" Level
  - Optimization Model Output Adjusted
- Opportunities to Realign Across Test Facility Categories (TFCs) and T&E Functional Areas (i.e., AV, A/W & EC) Identified
  - Optimization Model Output Adjusted
- Optimization Model Adjustments Based on the Following Ground Rules
  - Move Workload to Activity With Highest FV and Capabiltiy to Conduct Testing
    - Unless Compelling Reason to do Otherwise, in Which Case Must Be Justified
  - Maintain Unique Test Capabilities
  - Preserve Test Process

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As facility capabilities were evaluated, capability and capacity mismatches were identified. The optimization model workload assignments were adjusted to eliminate each capability mismatch. For example, long range over-land armament/weapons test hours were put back into WSMR, along with the test hours for NAWC (WSMR)'s "Desert Ship" capability.

In some cases, a facility's test hours represented a mixture of test types which crossed test facility categories. When data were provided to break these hours out into the appropriate category, it was done and the optimization model outputs (workload assignments) were adjusted. In other cases, data were not available to separate the hours, so the facility's workload was identified as a mismatch with other facility test hours and was kept separate (i.e., not combined or realigned). In a few cases, workload accomplished in a facility was assigned to the wrong test facility category by the activity in response to the T&E JCSG data call. These test hours and the associated capacities were adjusted (moved) into the correct test facility category to facilitate combining/ realigning the same type of testing.

If a facility was assigned to the wrong functional area, its workload and capacity were identified and eliminated from further analysis in that functional area. In one case, additional infrastructure savings were identified by realigning workload from one test facility category into another category. By realigning the activity's only facility, another activity was eliminated.

Opportunities to realign capabilities within a Test Facility Category were also identified so as to reduce the number of test facilities required to the minimum number necessary.

Adjustments to the optimization model output were made to move workload to the activity with the highest T&E functional value and the capability to conduct the testing, unless there were compelling reasons to do otherwise (in which case the reasons were documented). Adjustments to the optimization model output were also made to maintain unique test capabilities (e.g. High Speed Track Test Hours were adjusted back into AFDTC Holloman, since other tracks do not provide the required track length and speed) and to preserve the test process.

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## T&E JCSG Analysis Plan
## Overall Approach (Cont'd)

- Potential Opportunities Evaluated Against DoD T&E Requirements (Covered by T&E JCSG Policy Imperatives)
  - Primary Alternatives Identified
  - Major Cost Drivers Identified Using Certified Replacement Values as Guide
- Rough Order of Magnitude (ROM) Functional COBRA Analysis Conducted
  - Certified Data Used Wherever Available
  - Remaining Data Based on Expert Judgment

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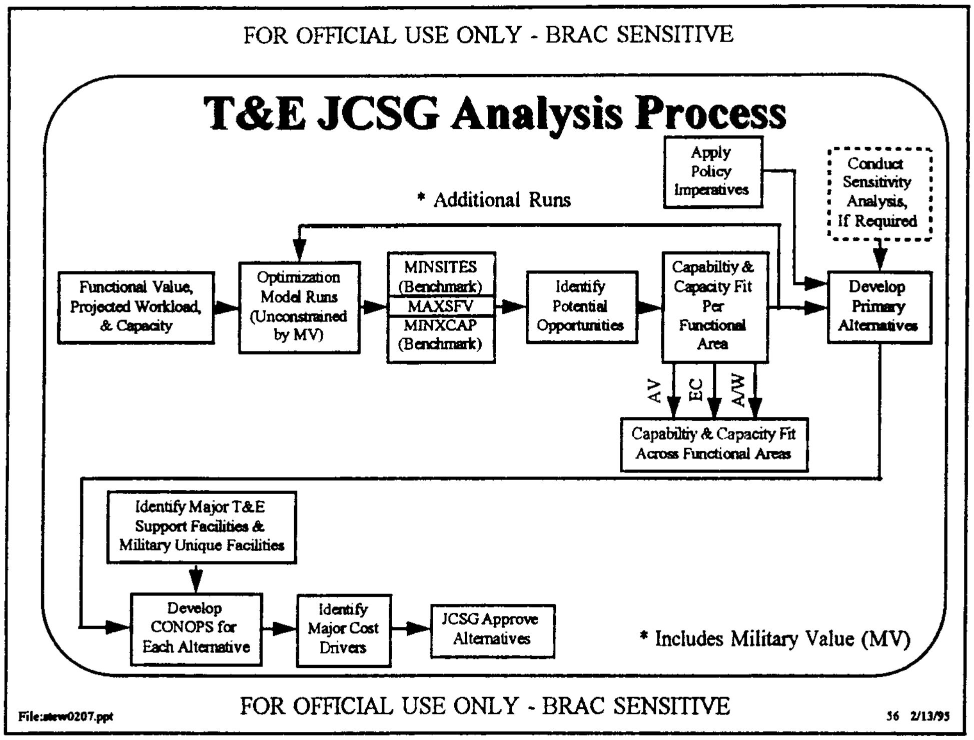
The adjusted optimization model workload assignments that resulted from this process represent the maximum realignments/consolidations which could be accomplished and indicate the minimum excess capacity achievable. These adjusted workload assignments point to potential realignment opportunities. To be considered "valid," each opportunity must meet the DoD T&E requirements and the T&E JCSG policy imperatives.

Due to the preponderance of costs associated with open air ranges and their supporting assets, such as aircraft, crews, maintenance, instrumentation, and range operations, the potential for the greatest DoD cost savings can occur by realigning open air range test hours to reduce the total number of DoD open air ranges. Other cost drivers are measurement facilities, hardware-in-the-loop facilities, and installed system test facilities. Integration laboratories and digital modeling and simulation facilities are relatively low cost facilities with less opportunity for DoD cost savings. (see Appendix C)

Valid realignment opportunities were costed using rough order of magnitude functional COBRA analyses. Certified data were used whenever available. When certified data were not collected, expert judgment was used to provide the remaining COBRA input data.



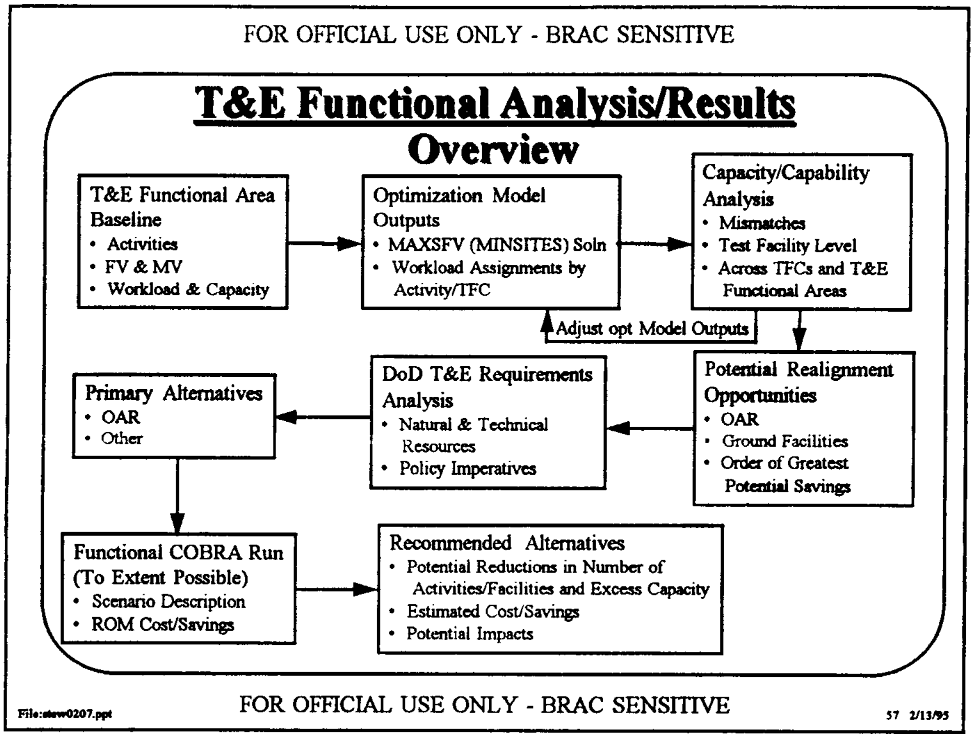

The analysis process described in this chart was approved during the T&E JCSG deliberations, documented in the T&E JCSG meeting minutes, and is based on the approved T&E JCSG analysis plan, documented as Reference 4 (see Appendix B for copy). It was approved by the T&E JCSG to guide the T&E JCSWG efforts.

The T&E Joint Cross Service Working Group (JCSWG) used this process to develop the T&E JCSG alternatives for "non-core" T&E alternatives before disbanding. The JCSWG jointly determined functional values, projected workload and capacities; and jointly ran the optimization model using the MAXSFV objective function to maximize functional values. The other objective functions (MINSITES and MINXCAP) were also run to minimize excess capacity, to minimize the number of activities required to accommodate the projected workload, and to establish benchmarks to support the analysis.

The T&E JCSWG did not accomplish a facility level capability and capacity fit per functional area (AV, A/W, and EC) for "core" T&E activities or across functional areas. Therefore, core alternatives to substantially reduce the T&E infrastructure were not developed.

Completion of the analysis process for "core" activities includes applying the policy imperatives to insure an alternative meets the DoD T&E requirements, conducting a sensitivity analysis to ensure robust alternatives, developing a concept of operations (CONOPS) for each viable alternative, and identifying major cost drivers/unique military facilities and support facilities.

The following charts describe the detailed steps followed in conducting the functional analysis for each area (AV, A/W and EC) at the test facility level for "core" T&E activities, and summarize the results based on completion of the T&E JCSG analysis process for each functional area.




These are the steps that were taken to complete the T&E JCSG analysis. These steps represent a more detailed breakout of the T&E JCSG process shown in the previous chart, and are consistent with the approach documented in the approved T&E JCSG analysis plan in Reference 4 (see Appendix B for copy).

The T&E baseline data for each functional area (i.e. AV, A/W, EC) and the optimization model outputs were taken directly from the T&E JCSG certified data and results (i.e., Reference 2 and other official T&E JCSG documentation residing in the OSD (ES) repository for JCSG data). These data served as a starting point for the Air Force analysis.

As indicated in the previous chart, several objective functions were run in the optimization model to provide benchmarks (e.g., minimum number of sites (MINSITES) that could accommodate the workload, minimum excess capacity, etc) and to assess the sensitivity of the optimization output to Functional Value (FV) and Military Value (MV) weighting. As described in the previous chart and documented in Reference 10 and Reference 2, the MAXSFV objective function was used for workload assignments. Such assignments are weighted by FV, which is a measure of a T&E activity's capability. Combined with the constraint of MINSITES, this objective function assigns the workload to T&E activities so as to maximize the FV (i.e., T&E capability) for the minimum number of sites required to accomplish the total DoD workload.

Starting with the T&E JCSG optimization model outputs, the next step is to conduct a capability and capacity fit to identify mismatches and to adjust the optimization model output accordingly. This analysis was conducted at the Test Facility level, as well as across Test Facility Categories (TFCs) and T&E Functional Areas. The necessity for this step was acknowledged in the T&E JCSG 22 Nov 94 transmittal memo, which states:

> **"In some cases, facilities with capabilities cutting across multiple TFCs were aggregated by respondents to the data call into a single facility which was categorized under a single TFC. This created some "misfits" in capacity and capability which were left intact for this level of analysis."**

In addition to adjusting the optimization model output for capability/capacity "misfits", the capability/capacity analysis includes adjustments based on opportunities for consolidating test facilities where there is a capability match, and fewer facilities can be used to satisfy the DoD workload.

This process results in the "Adjusted Optimization Model Workload" output, which provides the basis for identifying potential realignment opportunities.

In addressing potential realignment opportunities, priority was given to those aligned with the major cost drivers, and thus having the greatest potential for savings. Based on analysis of the T&E JCSG certified data for facility replacement values, operating costs, etc (Appendix C), the decreasing order of greatest potential savings is, by TFC: OAR, MF, HITL, ISTF, IL, and DM&S.

In order for a potential realignment opportunity to be viable, it must satisfy the total DoD T&E requirements and T&E JCSG policy imperatives. The requirements for natural resources were defined by the T&E JCSG Supplemental Data Call for critical air/land/sea space and by the measures of merit used for FV determination for climatology and topography. Similarly, the technical requirements are defined by a combination of measures of merit used in the FV determination and Policy Imperative 3b to "Retain the capabilities to preserve the test process" (i.e. any realignment must retain the capability across DoD that is used today to satisfy T&E requirements, but with fewer facilities).

If a potential realignment opportunity satisfies the DoD T&E requirements, it is retained as a primary alternative. Once again, OAR alternatives are considered first, since they yield the greatest potential for savings, before evaluating the remaining TFCs. OAR alternatives are expected to provide 60-70% of the potential savings possible, compared to realigning facilities in other TFCs.

In order to estimate the cost/savings, a concept of operations (CONOPS) and scenario description were required. For OAR alternatives, a detachment CONOPS, similar to the Army's existing AQTD operation for rotary-wing testing at Edwards was used. For the other TFC alternatives, it was assumed that the losing service would be integrated into the existing CONOPS at the gaining site. Certified data from the T&E JCSG data call were used, whenever available (e.g. tonnage of equipment, number of personnel, square footage, etc), and expert judgment was used to estimate the remainder. The COBRA model was used to provide the estimated cost/savings fully recognizing that these are rough estimates only.

Recommended alternatives were compared to the T&E baseline using several measures of merit: reductions in number of activities, number of facilities and excess capacity; estimated cost/savings, and return on investment. Impacts on other mission areas, customers/stakeholders, etc were also identified.

The next series of charts summarize the results from completing this process for "core" T&E activities for each of the three T&E functional areas in the following order: Electronic Combat, Armament/Weapons, and Air Vehicles

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# EC T&E Baseline
## DoD Workload (Test Hours)

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| AFDTC Eglin | 65 | | 2390 | | | 761 | 899 |
| NAWC Pt Mugu | 58 | | 487 | 459 | 223 | | |
| NAWC Pax River | 53 | | 148 | | | 2843 | |
| AFFTC Edwards | 52 | | | 3088 | | | 758 |
| NAWC China Lake | 47 | | 2311 | 1770 | | | 745 |
| EPG | 47 | 246 | 858 | | | | 369 |
| AFDTC Holloman | 29 | | 6091 | | | | |
| AFDTC AFEWES | 17 | | | | 2524 | | |
| NSWC Crane | 17 | | 4344 | | | | |
| AFDTC REDCAP | 15 | | | | 86 | | |

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This chart shows projected workload for T&E Activities as they exist today and calculated by the T&E JCSG. It represents part of the EC T&E baseline - a total of 10 T&E activities, each with it's functional value as calculated by the T&E JCSG. The activities are shown in order of T&E FV.

The 6 test facility categories (TFC) are shown across the top. Test facility subcategories are not shown.

The figures shown - test hours per year projected for FY 2001 - indicate the type(s) of EC T&E work each activity handles.

The detailed analysis for the EC T&E functional area can be found in Annex 1. Only key results and examples of the detailed analysis are presented in this part of the report.

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# Optimization Model Output (Test Hours)
## Electronic Combat

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| **AFDTC, Eglin AFB** | **65** | | **2902** | | | **2202** | **1978** |
| **NAWC, Pt Mugu** | **58** | | **98** | **850** | **420** | | |
| **NAWC, Pax River** | **53** | | **0** | | | **1402** | |
| **AFFTC, Edwards AFB** | **52** | | | **4467** | | | **112** |
| **NAWC, China Lake** | **47** | | **0** | **0** | | | **0** |
| **EPG** | **47** | **246** | **1924** | | | | **0** |
| **AFDTC, Holloman** | **29** | | **8402** | | | | |
| AFDTC, AFEWES | 17 | | | | 2413 | | |
| NSWC, Crane | 17 | | 3303 | | | | |
| AFDTC, REDCAP | 15 | | | | 0 | | |

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This Chart shows the output of the optimization model, as run by the T&E JCSG, when optimized for maximum functional value with the minimum number of sites. The minimum number of sites for EC was eight (8).

The model recommended realigning workload from two EC T&E activities AFDTC (REDCAP) and NAWC (China Lake) and six facilities (those shown with 0 workload remaining).

The model output was used to identify TFC's within which potential consolidations reside, as well as activities from which workload could be realigned.

The activities shown in bold type are those identified as "core" by the T&E JCSG. The T&E JCSWG was not allowed to realign workload from "core" activities during the development of alternatives. Only "non-core" alternatives were allowed.

Thus, JCSG options were limited to realigning workload from only three activities and three facilities, two of which, AFDTC (AFEWES) and NSWC (Crane), were not recommended by the model.

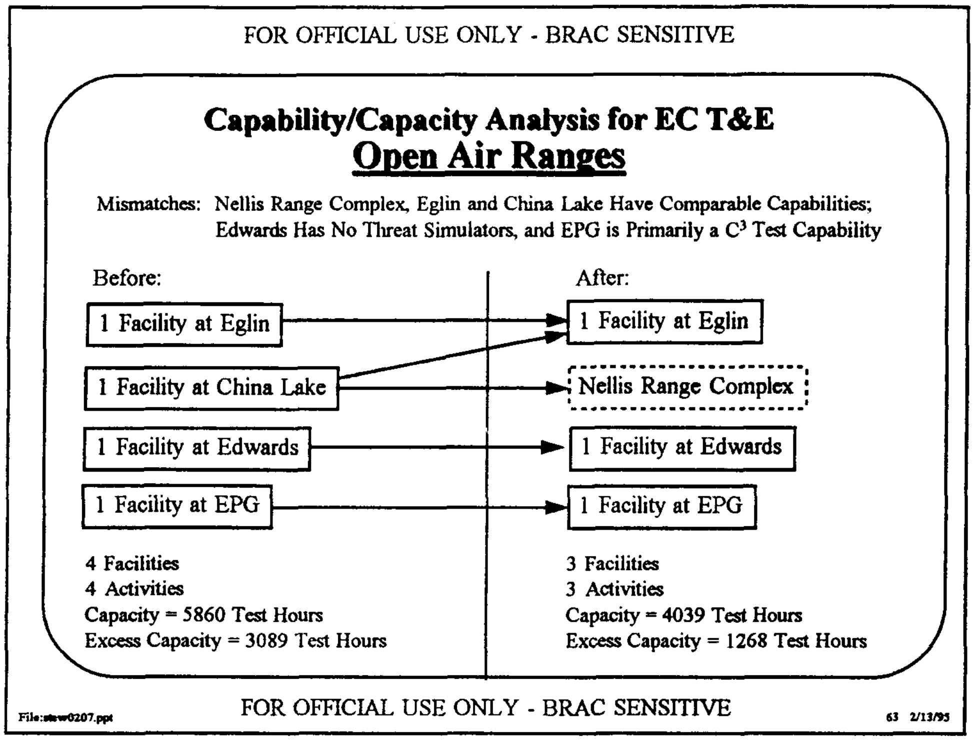
The T&E JCSWG analysis was driven by the following guidelines:

- don't realign workload from core activities,
- try to reduce total number of facilities and activities, and
- try to consolidate workload at MRTFB activities possessing an OAR.

Some realignments recommended by the model were deemed infeasible by the JCSWG due to technical or other reasons.

Realigning integration laboratory workload from NAWC (China Lake) to NAWC (Pt Mugu) and AFFTC (Edwards) may be technically infeasible due to the weapons-system-specific nature of integration laboratories (NAWC (China Lake) conducts antiradiation missile testing, while AFFTC (Edwards) supports F-15, F-16, and F-22 aircraft systems).

Realigning OAR workload from EPG to AFDTC (Eglin) may be technically infeasible as EPG conducts mostly C3 T&E which is a different capability than the EMTE OAR at Eglin.




This chart discusses realignment opportunities within the EC OAR TFC. Similar analyses were conducted for the other TFCs (see Annex 1), but only the OAR analysis is discussed here as an example.

The remainder of China Lake EC OAR workload, after filling the Nellis Range Complex, can be easily accommodated at AFDTC (Eglin), which has the higher FV.

EC T&E OAR capabilities at the Nellis Range Complex, AFDTC (Eglin), and NAWC (China Lake), although not entirely duplicative, have approximately 85% overlap. Projected workload figures suggest that DoD would be well served by realigning workload from one EC OAR thus reducing the number of similar facilities from three to two. Based on the T&E JCSG model output (see last chart) such workload is realigned from NAWC (China Lake) which has a lower FV. As the primary receiver site, the Nellis Range Complex would absorb most of the OAR workload from China Lake, with the remainder going to Eglin (higher FV than China Lake).

The only assets that would require transfer under this scenario are simulators representing sea-based threat systems, which would be relocated to a more realistic littoral environment (one with land/water contrast) at Eglin AFB, versus a desert environment only.

EC OAR testing done at AFFTC (Edwards) is done primarily in conjunction with either other functional area testing (air vehicle/avionics), for example, or testing done in conjunction with nearby ranges. Edwards AFB does not possess threat-specific simulators typically associated with EC OAR testing, and thus is not duplicative of the Nellis Range Complex, Eglin, or China Lake.

EPG's OAR testing primarily involves C3 work. This workload is also not duplicative of that done at other T&E facilities.

Consolidating three primary EC OARs into two would reduce the number of activities and facilities involved in EC testing, reduce excess capacity in this TFC by 59%, save I&M and O&M funds, and concentrate threat simulators into more realistic signal and pulse environments for testing.

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**Capability/Capacity Analysis for Electronic Combat T&E**

**Adjusted Optimization Model Workload (Test Hours)**

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| **AFDTC, Eglin AFB** | 65 | | 3000 | | | 761 | 963 |
| **NAWC, Pt Mugu** | 58 | | 0 | 0 | 0 | | |
| **NAWC, Pax River** | 53 | | 0 | | | 6369 | |
| **AFFTC, Edwards AFB** | 52 | | | 3088 | | 2610 | 1127 |
| **NAWC, China Lake** | 47 | | 0 | 2229 | | | 0 |
| **EPG** | 47 | 246 | 1924 | | | | 0 |
| **AFDTC, Holloman** | 29 | | 8402 | | | | |
| AFDTC, AFEWES | 17 | | | | 0 | | |
| NSWC, Crane | 17 | | 0 | | | | |
| AFDTC, REDCAP | 15 | | | | 0 | | |

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This chart shows adjusted output for the optimization model that results from completing the capability/capacity analysis for each of the six (6) TFCs and includes adjustments for the following two factors:

The proposed realignment of workload from the integration laboratory at NAWC (China Lake) has been deleted as it was deemed technically infeasible, and Workload figures for facilities not proposed for realignment were returned to their original values as it is highly unlikely that a portion of a facility's workload would be moved if the facility itself were to remain active.

Opportunities suggested by the adjusted optimization model outputs are thus:

Realign EC T&E OAR workload from NAWC (China Lake) to the Nellis Range Complex, with the remainder to AFDTC (Eglin).

Littoral T&E capabilities would be relocated to AFDTC Eglin, where a realistic littoral test environment exists. Per T&E JCSG guidance, the Nellis Range Complex is the highest priority OAR receiver site.

Realign EC T&E HITL workload from AFDTC (REDCAP).

Although the model recommended consolidation of such workload at Pt Mugu, the T&E JCSG recommended collocation of EC HITL and ISTF capabilities since EC HITL and ISTF capabilities are similar. Collocation of HITL and ISTF capabilities not only would save I&M and O&M funds; but would also facilitate implementation of the EC Test Process and improve correlation of test results.

Realign RCS measurement facility workload from NAWC (China Lake) to AFDTC (Holloman).

Although NAWC (China Lake) has a higher EC T&E FV than AFDTC (Holloman), the model assigned the China Lake workload to Holloman; whereas, Holloman can accept all related workload from China Lake. China Lake has neither the capability nor capacity to accept all RCS MF workload from Holloman.

Realigning the communications measurement facility workload from NAWC (Pax River) to EPG was identified as a potential consolidation but may be difficult as EC T&E represents only a portion of the communications measurement work done at the prior facility.

Thus, adjusting the model for realistic technical and workload factors provides focus on realignment opportunities within three TFCs/subcategories; OAR, HITL, and RCS measurement facilities. Such opportunities would enable four facilities and one activity to be realigned.

Completion of the analysis focused on OAR's first because, although not the major contributor of capacity or excess capacity, they are the most expensive type of test resource to build, maintain, and operate and thus offer the greatest potential for cost savings.

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## EC T&E
## Potential Realignment Opportunities

- Non-Core (JCSG) Alternatives
  - TE-1 (EC): Realign HITL at AFDTC Buffalo (REDCAP)
  - TE-2 (EC): Realign HITL at AFDTC Ft Worth (AFEWES)
  - TE-3 (EC): Realign EM Effects MF at NSWC Crane
- Core
  - Core-1 (EC): Realign NAWC China Lake OAR to Nellis Range Complex and AFDTC Eglin
  - Core-2 (EC): Realign NAWC China Lake RCS MF to AFDTC Holloman
- Additional Core
  - Realign Signature MF from NAWC Pt Mugu to AFDTC Eglin
  - Realign Communications MF from NAWC Pax River to EPG
  - Realign IL from NAWC Pt Mugu to NAWC China Lake
  - Realign HITL from NAWC Pt Mugu to ISTF at NAWC Pax River
  - Realign OAR from EPG to AFFTC Edwards

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Several opportunities for realignment became apparent upon reviewing the optimization model outputs. Other opportunities also became apparent, once excess capacity was analyzed for TFC's which had more than one EC test facility.

Excess capacity in a TFC with only one facility should be viewed as capacity bought in the process of opening the facility's doors -- it can't be reduced without eliminating all associated capacity and capability. However, for those TFCs for which more than one facility exists, it may be possible to reduce capacity by consolidating workload and realigning one or more facilities.

There are three general categories of realignment opportunities: non-core, core, and additional core.

Non-core alternatives are those which propose to realign workload from a non-core EC T&E activity to a core T&E activity. Since the T&E JCSWG was restricted from realigning workload from core activities, all T&E JCSG alternatives fall into the non-core category. There are three non-core alternatives involving EC, as shown.

Core alternatives are those which recommend realigning workload from a core EC T&E activity to another core activity. Since the T&E JCSWG was restricted from developing core alternatives, the two shown for EC were developed herein during completion of the T&E JCSG analysis plan.

Additional Core alternatives offer the only opportunities for effectively addressing large excess capacities existing in some TFCs. They were developed at the facility level, assuming (as indicated) significant cost savings can occur as a result of realigning workload from some facilities existing at core activities.

There are two core alternatives involving EC T&E, as shown.

Finally, five additional core alternatives were developed by evaluating those test facility categories having more that one facility and significant excess capacity. The additional core alternatives have not been more fully developed because:

1) the facilities involved typically do more than EC T&E (cross both functional and mission areas), and

2) payback in terms of projected savings is not expected to be as large as projected for the above core alternatives. Together, these additional core alternatives could further reduce excess EC T&E capacity 11%.

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# Recap
# Electronic Combat T&E

| Option | Activities | Facilities | DoD Capacity (Test Hours) | DoD Excess Capacity (Test Hours) | Comments |
|---|---|---|---|---|---|
| Baseline | 10 | 24 | 64909 | 33501 | |
| Non-Core (JCSG) Alternatives | 7 <30%> | 22 <8%> | 52284 <19%> | 21244 <36%> | Non-Core Realigned |
| Core-1 (EC) (OAR) | 7 <30%> | 21 <12%> | 50463 <22%> | 19744 <40%> | Non-Core Realigned Plus OAR Consolidation |
| Core-2 (EC) (RCS MF) | 7 <30%> | 20 <17%> | 46980 <28%> | 16261 <51%> | Non-Core Realigned Plus OAR & RCS MF Consolidation |
| Add'l Alternatives * | 6 <40%> | 14 <42%> | 43389 <33%> | 12670 <62%> | Core and Non-Core Realigned |

* Maximum Reductions Achievable <> = % Reduction

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This chart shows the number of today's activities, facilities, and capacity supporting EC T&E, and the top-level results of implementing the non-core, two separate core, and combined additional core alternatives in sequence.

Results are cumulative.

The bottom line is that although the JCSG alternatives are a step forward and will reduce EC T&E excess capacity by 37%, if implemented, an additional 25% reduction in excess capacity is possible if realignment of workload between core activities (at the facility level) were accomplished.

More importantly, this additional reduction in excess capacity would occur in those TFCs which typically are the most expensive to build, operate, and maintain, and thus offer the greatest potential for cost savings.

In addition, the maximum reductions achievable, shown at the bottom, represent the minimum T&E infrastructure and excess capacity achievable (i.e. each TFC/T&E capability is one facility deep, or if more than one facility, then additional facilities are needed to accommodate the projected workload or it is weapon system unique).

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**Armament/Weapons T&E Baseline**

## DoD Workload (Test Hours)

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| AFDTC Eglin | 82 | 39,324 | 13,144 | | 12,085 | 168 | 7,598 |
| NAWC Pt Mugu | 77 | 3,916 | 18,275 | 5,774 | 39,225 | | 4,068 |
| NAWC China Lake | 57 | 12,065 | 45,387 | 7,594 | 1,357 | | 2,169 |
| NAWC Pax River | 57 | | | | | 624 | |
| WSMR | 50 | | 7,608 | | | | 13,275 |
| AFDTC Holloman | 30 | | 5,129 | | | | |
| YPG | 29 | | 127 | | | | 2,055 |
| NAWC WSMR | 25 | | | | | | 1,791 |
| RTTC | 21 | | 30,089 | | | | 786 |
| NSWC Dahlgren | 17 | | 954 | | | | |
| AEDC Arnold | 16 | | 2,107 | | | | |
| NSWC Indian Head | 14 | | 2,196 | | | | |
| NSWC Crane | 13 | | 1,142 | | | | |

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This chart shows the projected workload for Armament/Weapons for T&E activities as they exist today. These values were estimated by the T&E JCSG by taking 72% of the FY92/FY93 average workload as reported in certified data. These data were inputs to the optimization model.

The 13 activities involved in Armament/Weapons T&E are listed in descending order of functional value. Each activity's FY2001 projected workload is identified by the 6 test facility categories (TFCs).

The detailed analysis for the A/W T&E functional area can be found in Annex 2. Only key results and examples of the detailed analysis are presented in this part of the report.

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**Optimization Model Output**
## Armament/Weapons Workload (Test Hours)
**MAXSFV (MINSITES)**

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| **AFDTC Eglin** | 82 | 55,305 | 29,523 | | 18,611 | 443 | 16,036 |
| **NAWC Pt Mugu** | 77 | 0 | 59,481 | 11,916 | 34,056 | | 11,609 |
| **NAWC China Lake** | 57 | 0 | 24,782 | 1,452 | 0 | | 3,986 |
| **NAWC Pax River** | 57 | | | | | 349 | |
| **WSMR** | 50 | | 396 | | | | 111 |
| **AFDTC Holloman** | 30 | | 11,221 | | | | |
| **YPG** | 29 | | 0 | | | | 0 |
| **NAWC WSMR** | 25 | | | | | | 0 |
| RTTC | 21 | | 0 | | | | 0 |
| NSWC Dahlgren | 17 | | 0 | | | | |
| **AEDC Arnold** | 16 | | 755 | | | | |
| NSWC Indian Head | 14 | | 0 | | | | |
| NSWC Crane | 13 | | 0 | | | | |

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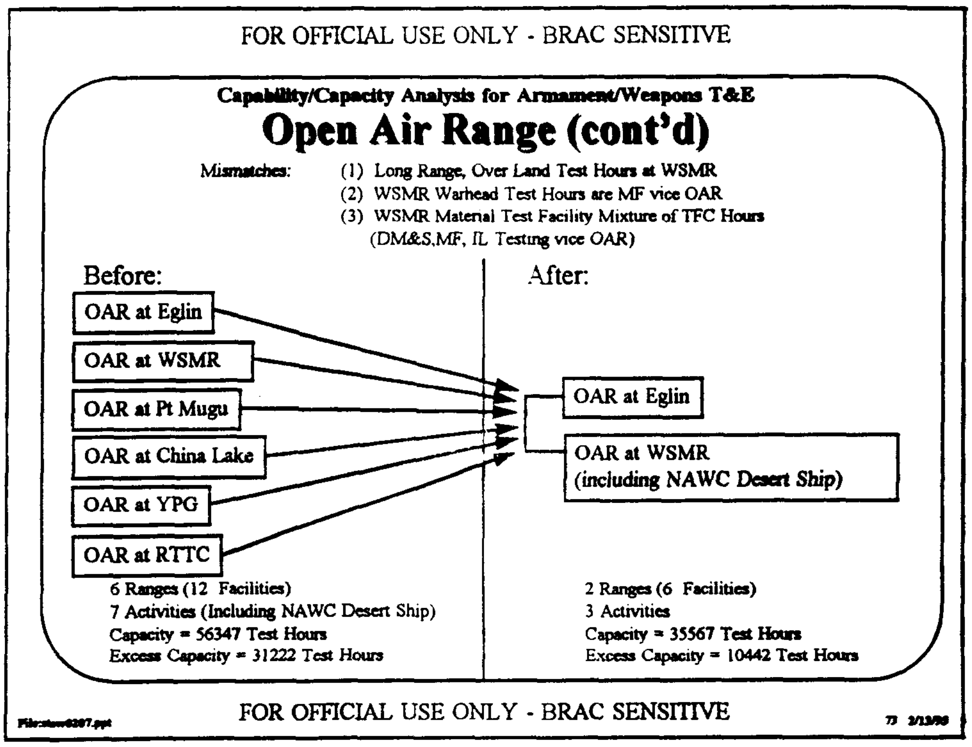
This chart shows the output of the optimization model as run by the T&E JCSG. The resulting workload assignments are shown for the objective function MAXSFV (MINSITES). Again, this objective function loads work into the highest functional value activity with capacity to perform all or part of the workload and constrains the total number of activities to the minimum number of activities required to accommodate the workload. In the case of Armament/Weapons, the minimum number of activities is seven. The T&E JCSG "core" activities are shown in bold print. The optimization model realigned workload as follows:

a) Measurement facility work realigned from NSWC (Crane), NSWC (Indian Head), NSWC (Dahlgren), AEDC (Arnold).
b) Measurement facility and open air range work realigned from Redstone Technical Test Center (RTTC), Yuma Proving Ground (YPG), and White Sands Missile Range (WSMR).
c) Open air range work realigned from NAWC (WSMR).
d) Digital modeling and simulation work realigned from NAWC (China Lake) and NAWC (Pt Mugu).
e) Hardware-in-the-loop work realigned from NAWC (China Lake).
f) Measurement facility sled track work realigned from AFDTC (Holloman) and NAWC (China Lake).
g) Integration laboratory and measurement facility environmental work realigned from NAWC (China Lake).

The optimization model outputs indicated that six of the 13 activities could be totally realigned and their Armament/Weapons T&E work could be accomplished by higher functional value activities. The activities realigned (i.e. eliminated) by the optimization model are:

a) NSWC Crane
b) NSWC Dahlgren
c) NSWC Indian Head
d) Redstone Technical Test Center
e) Yuma Proving Ground, and
f) NAWC WSMR.

The optimization model workload assignments were accomplished at the TFC level versus the facility level. Therefore, capability mismatches occur in four of the TFCs. These mismatches have to be eliminated by adjusting the optimization model workload assignments to insure technically valid (feasible) realignment opportunities are evaluated.




Each TFC's facilities were evaluated to identify capability and capacity mismatches to ensure unique DoD capabilities were retained, and to maintain the facilities required to support the Armament/Weapon test process. One example is shown for open air ranges. The remaining five (5) TFCs are shown in Annex 2.

First, capability mismatches were eliminated. WSMR warhead testing is moved from OAR to measurement facility guns/ordnance. WSMR Material Testing is separated from OAR testing, since it is a mixture of DM&S, MF, and IL testing. And, test hours for WSMR long-range, over-land testing is moved back into WSMR and NAWC WSMR (Desert Ship), because other ranges cannot support these types of tests. Second, the OAR workload and capacity test hours are adjusted to reflect the above changes. Third, workload is reassigned to the activity with the highest functional value, in accordance with the MAXSFV objective function, and the facility capability to support the testing.

These OAR adjustments to the optimization model output indicate that 6 ranges could be reduced to 2 ranges, AFDTC (Eglin) and WSMR (including NAWC Desert Ship). The number of OAR facilities are reduced from 12 to 6. Capacity is decreased from 56,347 to 35,567 test hours which is a 37% reduction, and excess capacity is decreased from 31,222 to 10,442 test hours which is a 67% reduction.

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**Capability/Capacity Analysis for Armament/Weapons T&E**

## Adjusted Optimization Model Workload (Test Hours)

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| **AFDTC Eglin** | 82 | 55,305 | 28,736 | | 16,667 | 792 | 16,036 |
| **NAWC Pt Mugu** | 77 | 0 | 39,010 | 0 | (1) 0 | | 0 |
| **NAWC China Lake** | 57 | 0 | 13,609 | 13,368 | 0 | | 0 |
| **NAWC Pax River** | 57 | | | | | 0 | |
| **WSMR** | 50 | | 20,278 | | | | (2) 7,298 |
| **AFDTC Holloman** | 30 | | 21,812 | | | | |
| **YPG** | 29 | | 0 | | | | 0 |
| **NAWC WSMR** | 25 | | | | | | 1,791 |
| RTTC | 21 | | 0 | | | | 0 |
| NSWC Dahlgren | 17 | | 0 | | | | |
| **AEDC Arnold** | 16 | | 2,107 | | | | |
| NSWC Indian Head | 14 | | 0 | | | | |
| NSWC Crane | 13 | | 0 | | | | |

Note: (1) Plus 36,000 Test Hours (DM&S, MF, IL Combination)
(2) Plus 6,246 Test Hours (DM&S, MF, IL Combination)

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The results of performing a facility level capability and capacity analysis for each of the six (6) TFCs are shown on this chart. Workload assignment adjusted from the optimization model output are boxed, and the T&E JCSG "core" activities are shown in bold print. The adjusted workload assignments indicate the maximum reduction (realignment) possible within the DoD for Armament/Weapons T&E. The minimum Armament/Weapons T&E infrastructure includes:

a) One activity AFDTC (Eglin) to support DM&S, HITL and ISTF testing.
b) Two ranges, AFDTC (Eglin) and WSMR, to meet DoD capability and capacity requirements.
c) One activity NAWC (China Lake) to support IL testing.
d) Six activities to meet DoD MF capability and capacity requirements.

Six activities could be totally realigned (eliminated) - NSWC (Crane), NSWC (Dahlgren), NSWC (Indian Head), RTTC, YPG, and NAWC (Pax River). NAWC (Pt Mugu) could be substantially realigned to provide predominately MF testing, and NAWC (China Lake) could be realigned to provide MF and IL testing.

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## Armament/Weapons T&E
## Potential Realignment Opportunities

- Non-Core (JCSG) Alternatives
  - TE-1 (A/W): MF Workload from NSWC Crane
  - TE-2 (A/W): MF Workload from NSWC Dahlgren
  - TE-3 (A/W): MF Workload from NSWC Indian Head
  - TE-4 (A/W): MF and OAR Workload from RTTC
- Core Alternatives
  - Core-1 (AW): OAR Workload from NAWC Pt Mugu, China Lake, and YPG to AFDTC Eglin and WSMR
- Additional Core
  - Realign Ground Facilities
    - Impacts Navy and Army Weapons R&D, Surface-to-Surface T&E, etc.

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The adjusted optimization model points to three types of realignment opportunities for Armament/Weapons T&E.

a) Realignment of all non-core activities, which is the same as the T&E JCSG alternatives.

(1) TE-1 (A/W) realigns all MF workload from NSWC (Crane).
(2) TE-2 (A/W) realigns all MF workload from NSWC (Dahlgren).
(3) TE-3 (A/W) realigns all MF workload from NSWC (Indian Head).
(4) TE-4 (A/E) realigns all MF and OAR workload form RTTC.

b) Realignment of core open air range workload from NAWC (Pt Mugu), NAWC (China Lake) and YPG to AFDTC (Eglin) and WSMR.

c) Realignment of core ground facility (DM&S, MF, IL, HITL, and ISTF) workload from NAWC (Pt Mugu), NAWC (China Lake), NAWC (Pax River), and YPG to the maximum extent possible.

Realignment of core ground facility workload would impact the Navy and Army's research and development activities and their surface-to-surface T&E, since the same facilities are frequently used to support multiple Service requirements.

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## Recap
## Armament/Weapons T&E

| Options | Activities | Facilities | DoD Capacity (Test Hours) | DoD Excess Capacity (Test Hours) | Comments |
|---|---|---|---|---|---|
| Baseline (Adjusted) | 13 | 79 | 549,291 | 270,236 | |
| Non-Core (JCSG) Alternatives | 9 <31%> | 68 <14%> | 495,823 <10%> | 216,768 <20%> | Non-Core Realigned |
| Core-1 (A/W) OAR Realignment | 9 <31%> | 62 <22%> | 476,231 <13%> | 197,176 <27%> | Non-Core Realigned Plus MRTFB OAR Consolidation |
| Add'l Core Ground Facility Realignment * | 6 <54%> | 37 <53%> | 359,594 <35%> | 80,539 <70%> | Core and Non-Core Realigned |

* Maximum Reductions Achievable

<> = % Reduction

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In summary, the adjusted Armament/Weapons T&E baseline contains 13 activities and 79 facilities broken out as follows:

| | | |
|---|---|---|
| a) Air Force - | 3 activities, | 15 facilities, |
| b) Navy - | 7 activities, | 51 facilities, and |
| c) Army - | 3 activities, | 13 facilities. |
| Totals | 13 | 79 |

Executing the non-core T&E JCSG alternatives would reduce the number of activities by 4 and the number of facilities by 11. These reductions result in a 31% reduction in activities, a 14% reduction in facilities, a 10% reduction in DoD capacity and a 20% reduction in DoD excess capacity. The resulting breakout by Service would be :

| | | |
|---|---|---|
| a) Air Force - | 3 activities, | 15 facilities, |
| b Navy - | 4 activities, | 44 facilities, and |
| c) Army - | 2 activities, | 9 facilities. |
| Totals | 9 | 68 |

Executing the core OAR realignment option in addition to the T&E JCSG alternatives would reduce the number of facilities by an additional 6, would reduce the number of ranges to 2, and would eliminate 37% of the DoD OAR capacity and 67% of the DoD OAR excess capacity. This option focuses on the MRTFB OARs which captures the majority of the DoD T&E costs associated with Armament/Weapons. The potential DoD savings are addressed in the cost analysis section. The resulting breakout by Service is:

| | | |
|---|---|---|
| a) Air Force - | 3 activities. | 15 facilities, |
| b) Navy - | 4 activities, | 41 facilities, and |
| c) Army - | 2 activity, | 6 facilities. |
| Totals | 9 | 62 |

Executing the core ground facility realignment option, in addition to the T&E JCSG alternatives, and OAR realignments would maximize the DoD reductions achievable and reduce the DoD Armament/Weapons T&E infrastructure to the minimum level which meets DoD capability and capacity requirements. By moving 3 Pt Mugu measurement facilities to China Lake and management transferring the Strike Weapons Evaluation Facility from Pt Mugu to China Lake, the number of Armament/Weapons T&E activities could be reduced to 6. The number of facilities are minimized at 37 and the DoD excess capacity is reduced by 70%. The resulting breakout by Service is:

| | | |
|---|---|---|
| a) Air Force - | 3 activities, | 15 facilities, |
| b) Navy - | 2 activities, | 17 facilities, and |
| c) Army - | 1 activity, | 5 facilities. |
| Totals | 6 | 37 |

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## Air Vehicles T&E Baseline
### DoD Workload (Test Hours)

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| AFFTC, Edwards | 85 | 270 | 2360 | 69485 | | 121 | 7583 |
| NAWC, Pax River | 81 | | 27288 | 2275 | 112239 | 9553 | 7661 |
| NAWC, Pt Mugu | 69 | | 327 | | | | 1679 |
| AFDTC, Eglin | 58 | | 4911 | | | | |
| 476 WEG, Tyndall | 47 | | | | 1932 | | |
| UTTR, Hill | 46 | | | | | | 1940 |
| AQTD, Edwards | 46 | | | | | | 1258 |
| EPG, Ft Huachuca | 44 | | 398 | | | | 277 |
| NAWC, China Lake | 43 | | 1830 | | | | |
| YPG, Yuma | 35 | | 131 | | | | 3404 |
| ATTC, Ft Rucker | 34 | | | | | | 3776 |
| AFDTC, Holloman | 33 | | 27530 | | | | |
| NSWC, Dahlgren | 25 | | 943 | | | | |
| NAWC, Indianapolis | 19 | | 16324 | 10046 | | | |
| AEDC, Arnold | 18 | | 2569 | | | | |
| NAWC, Warminster | 14 | 1003 | | | | | |

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This chart shows the projected workload for T&E activities as they exist today and calculated by the T&E JCSG.

The Air Vehicle functional area baseline consisted of 16 activities which reported air vehicle T&E workload in one or more test facilities (greater than 5% T&E and 100 test hours). Functional values and workload shown were extracted from the T&E JCSG calculated values and certified data.

Fifty one test facilities were grouped into six Test Facility Categories (TFC). The activity workload in each TFC is an aggregate of all facilities located at the activity. In some cases, facility capabilities were not compatible among aggregated facilities, thus leading to a capability mismatch which is addressed later in the analysis.

The majority of the test facilities supporting the AV test process are located at the two major air vehicle test centers, AFFTC (Edwards) and NAWC (Pax River), as reflected in the workload distribution across the six TFCs.

The majority of test facilities at 14 other activities are concentrated in the measurement facilities (MF) and open air range (OAR) TFCs. For many of these activities, air vehicle T&E workload represents only a small part of activity workload.

The detailed analysis for the AV T&E functional area can be found in Annex 3. Only key results and examples of the detailed analysis are presented in the part of the report.

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## Optimization Model Output (Test Hours)
## Air Vehicles T&E

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| **AFFTC, Edwards** | 85 | 1273 | 3392 | 81806 | | 1968 | 11998 |
| **NAWC, Pax River** | 81 | | 30703 | 0 | 114171 | 7706 | 12246 |
| **NAWC, Pt Mugu** | 69 | | 575 | | | | 3334 |
| **AFDTC, Eglin** | 58 | | 0 | | | | |
| 476 WEG, Tyndall | 47 | | | | 0 | | |
| **UTTR, Hill** | 46 | | | | | | 0 |
| AQTD, Edwards | 46 | | | | | | 0 |
| **EPG, Ft Huachuca** | 44 | | 0 | | | | 0 |
| **NAWC, China Lake** | 43 | | 0 | | | | |
| **YPG, Yuma** | 35 | | 0 | | | | 0 |
| ATTC, Ft Rucker | 34 | | | | | | 0 |
| **AFDTC, Holloman** | 33 | | 27985 | | | | |
| NSWC, Dahlgren | 25 | | 943 | | | | |
| NAWC, Indianapolis | 19 | | 21013 | 0 | | | |
| **AEDC, Arnold** | 18 | | 0 | | | | |
| NAWC, Warminster | 14 | 0 | | | | | |

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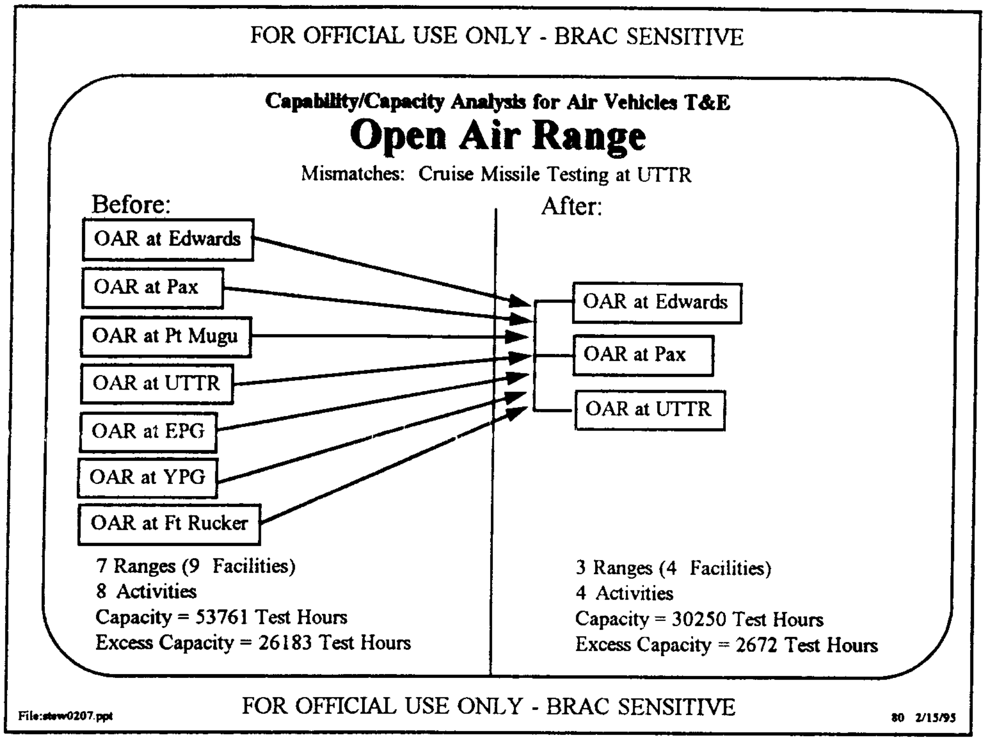
This chart shows the output of the optimization model as run by the T&E JCSG. The purpose of the optimization model was to consolidate workload within each test facility category while minimizing the number of activities involved.

The objective functions used in the model placed workload in each facility category at the activity with the highest functional value with available capacity. The number of activities was constrained to the minimum needed to accommodate the baseline workload, in this case six.

The optimization model was run using the workload requirements and available capacity from the T&E JCSG certified data. Functional values were determined by the T&E JCSG using certified data. The resulting workload distribution from the optimization model run is shown in the table above and was obtained from the optimization runs conducted by the T&E JCSG.

The algorithm had no knowledge of capability mismatches among the consolidated TFC workloads. Thus the model served primarily as a starting point to indicate where consolidation opportunities might be found. Functional area expertise and judgment are applied later in the analysis to determine which of the indicated consolidations can realistically be accomplished.

The T&E JCSG designated activities as "core" and "non-core" and severely constrained potential consolidations by limiting transfer of work only from "non-core" activities. The ten designated "core" activities as shown in bold type in the table indicating substantial potential consolidation opportunities were placed "off limits" to the T&E JCSWG. Only 8 of 51 test facilities (16%) at "non-core" activities were evaluated for consolidation in the joint cross-service arena.




This chart shows the capability/capacity analysis for the OAR TFC, as an example. Similar analysis for the other six (6) TFCs can be found in Annex 3.

The optimization model suggested consolidating all Air Vehicle OAR test work into three activities, AFFTC (Edwards), NAWC (Pax River), and NAWC (Pt Mugu).

The open air ranges at AFFTC (Edwards) and NAWC (Pax River) are jointly capable of accommodating DoD technical requirements for Air Vehicle T&E with few exceptions. One such exception is test requirements for cruise missile testing currently conducted at UTTR.

Neither AFFTC (Edwards) nor NAWC (Pax River) alone is capable of meeting the full spectrum of Air Vehicle test requirements (e.g., maritime and carrier suitability requirements unique to Pax River versus large overland recovery areas unique to Edwards). Based on expert judgment, 25% to 40% of Air Vehicle testing would have to be deployed if consolidated at either AFFTC (Edwards) or NAWC (Pax River).

Both AFFTC (Edwards) and NAWC (Pax River) indicated the upper limit of safe open air test operations to be on the order of 40% above peak demonstrated capacity. Either site would have to operate over 100% above demonstrated peak to accommodate the entire Air Vehicle OAR projected workload and, as noted above, would still be unable to satisfy all DoD requirements at one location.

The combination of OAR facilities at AFFTC Edwards, NAWC (Pax River) and UTTR can satisfy the capability and capacity requirements for all DoD Air Vehicle T&E with the minimum number of activities. While technically a separate activity, AQTD is a tenant at the AFFTC Edwards. This facility would remain open to accommodate the Army's rotary wing testing.

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**Capability/Capacity Analysis for Air Vehicles T&E**
**Adjusted Optimization Model Workload (Test Hours)**

| Activity | Functional Value | DM&S | MF | IL | HITL | ISTF | OAR |
|---|---|---|---|---|---|---|---|
| **AFFTC, Edwards** | **85** | 270 | 2360 | 71417 | | 121 | 13395 |
| **NAWC, Pax River** | **81** | | 27405 | 11065 | 130822 | 10496 | 9340 |
| **NAWC, Pt Mugu** | **69** | | 0 | | | | 0 |
| **AFDTC, Eglin** | **58** | | 5238 | | | | |
| 476 WEG, Tyndall | 47 | | | | 0 | | |
| **UTTR, Hill** | **46** | | | | | | 2217 |
| AQTD, Edwards | 46 | | | | | | 2626 |
| **EPG, Ft Huachuca** | **44** | | 0 | | | | 0 |
| **NAWC, China Lake** | **43** | | 2095 | | | | |
| **YPG, Yuma** | **35** | | 0 | | | | 0 |
| ATTC, Ft Rucker | 34 | | | | | | 0 |
| **AFDTC, Holloman** | **33** | | 27677 | | | | |
| NSWC, Dahlgren | 25 | | 0 | | | | |
| NAWC, Indianapolis | 19 | | 0 | 0 | | | |
| **AEDC, Arnold** | **18** | | 2569 | | | | |
| NAWC, Warminster | 14 | 0 | | | | | |

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The table above indicates the "potential" for consolidating the Air Vehicle T&E workload into facilities with similar test capabilities when all activities, core and non-core, are included. This "potential" consolidation was based on the capability/capacity analysis for all six TFC's. The workload assignment at AFDTC (Eglin) was driven by the uniqueness of the McKinley Climatic Chamber and the airborne Multi-Spectral Signature Measurement capability.

In some cases it was assumed that sufficient equipment would be moved from a losing facility to a gaining facility in order to augment the gaining facility's technical capabilities.

No considerations were given for the impacts of Air Vehicle workload transfer on other workload at a losing facility. In a number of cases the transferred Air Vehicle T&E workload was less than 20% of a facility's total workload.

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## Air Vehicles T&E
## Potential Realignment Opportunities

- Non-Core (JCSG) Alternatives
  - TE-1 (AV): Realign Ft Rucker Rotary Wing OAR to YPG
  - TE-2 (AV): Realign AQTD Rotary Wing OAR to YPG
  - TE-3 (AV): Realign NAWC, Indianapolis ILs to Pax River and Realign NAWC, Indianapolis Product Quality Assurance MF to TBD
  - TE-4 (AV): Realign NSWC, Dahlgren EM Vulnerability MF to Pax River
  - TE-5 (AV): Realign NAWC, Warminster DM&S Centrifuge to Pax River
  - TE-6 (AV): Realign Tyndall RADAR Test HITL to Another Air Force Activity
- Core Alternative
  - Core-1 (AV): Consolidate OAR Workload into Three MRTFB Ranges: AFFTC Edwards, NAWC Pax River, and UTTR Hill
- Additional Core:
  - Sea Level Climatic Workload from Pt Mugu to McKinley Climatic Lab, Eglin

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Six "non-core" alternatives were developed by the T&E JCSG for non-core activities, using the optimization model as a guide, with the constraint of no workload transfer allowed from a core activity. Only 8 of 51 test facilities were available for realignment consideration.

- Each of the 8 available test facilities was assessed for transfer to core activities with workload in the same TFC. A "preferred" gaining activity was recommended in most cases.

- Most of these transfers would be cost effective only if necessitated by closure of the associated activity.

Core alternative-1 (AV) reflects a consolidation of Air Vehicle T&E into the fewest open air ranges (OARs) sufficient to accommodate the workload with the required technical capabilities.

An additional alternative, which could be realistically accomplished, would consolidate workload from a smaller climatic test facility at NAWC (Pt Mugu) to the larger one at AFDTC (Eglin). This transfer has already been agreed to by the AF and Navy under Project Reliance.

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# Recap
# Air Vehicle T&E

| Options | Activities | Facilities | DoD Capacity (Test Hours) | DoD Excess Capacity (Test Hours) | Comments |
|---|---|---|---|---|---|
| Baseline | 16 | 51 | 509,612 | 190,499 | |
| Non-Core (JCSG) Alternatives | 10 <37%> | 46 <10%> | 486,210 <5%> | 167,097 <12%> | Non-Core Realigned |
| Core-1 (AV) OAR Realignment | 11 <31%> | 43 <16%> | 474,965 <7%> | 155,852 <18%> | Non-Core Realigned Plus MRTFB OAR Consolidation |
| Add'l Alternative * | 10 <37%> | 42 <18%> | 474390 <7%> | 155604 <18%> | Core and Non-Core Realigned |

* Maximum Reductions Achievable

<> = % Reduction

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The above table summarizes the "potential" consolidation which might be achieved in test facilities which conduct some workload in the Air Vehicle T&E functional area. Most of the identified realignment opportunities are not likely to be cost effective unless the host activity would be closed as a result of BRAC 95.

Except for some specialized test facilities which are impractical to relocate, most of the test facilities required for Air Vehicle T&E are currently located at AFFTC (Edwards) or NAWC (Pax River). While some duplication exists between test facilities at these two activities, it is generally in areas which support/augment OAR flight testing and they are needed to support the total workload. Thus, there does not appear to be a great deal of opportunity for cost effective consolidation in the Air Vehicle T&E functional area.

It should be noted that the maximum reductions achievable, shown at the bottom of the table, represent the minimum T&E infrastructure and excess capacity achievable (i.e. each TFC/T&E capability is one facility deep, or if more than one facility, then additional facilities are needed to accommodate the projected workload or it is weapon system unique). These values represent a goal for AV T&E to strive for in considering realignment/consolidation opportunities.

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## T&E Functional Analysis/Results

### Recap

- Realign DoD Air Vehicles T&E Into AFFTC (Edwards) and NAWC (Pax River), to Include Rotary Wing
  - Both Required to Satisfy DoD Requirements
- Realign DoD A/W OAR T&E Into AFDTC (Eglin) and Army WSMR
  - Both Required to Satisfy DoD Requirements
  - Retain Navy Ground Facilities to Support Weapons R&D
- Realign EC OAR T&E from NAWC (China Lake) to Nellis Complex and AFDTC (Eglin)
  - Combined with Consolidation of EC Ground Facilities at AV Principal Sites, Satisfies DoD Requirements
- Retain Required Specialty Sites to Support Above
  - AEDC
  - AFDTC (Holloman)
  - UTTR (Air/Land Space)

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Based on completion of the T&E JCSG analysis plan, using certified T&E JCSG data, further reductions in excess capacity among "core" T&E Activities is possible. Since the primary purpose of realignments/consolidations of the T&E infrastructure is to achieve savings in the future, emphasis was placed on the development of alternatives for TFCs in the order of greatest potential savings (i.e. OAR, MF, HITL, ISTF, IL, and DM&S) and least impact on other missions, etc. Since OARs offer the greatest potential for savings, are all part of the MRTFB and predominantly used for T&E (whereas ground facilities supporting T&E are not), and therefore offer the least potential for impacting other mission areas such as S&T, ISE etc. (which is not the case for all ground facilities), the focus was placed on OARs to identify potentially "clean" T&E realignment alternatives. It should also be noted that these alternatives are evaluated against current T&E requirements for DoD, as reflected in the current T&E infrastructure, and not against future T&E requirements, since such data were not gathered by the T&E JCSG data call

For Air Vehicles OAR, the two best sites to accommodate the projected T&E workload (including Rotary Wing) are AFFTC (Edwards) and NAWC (Pax River). With the addition of a few specialty sites, this combination satisfies all DoD requirements (capability and capacity/workload) and all T&E JCSG policy imperatives (see Annex 3 for details). It also represents the minimum T&E infrastructure required for Air Vehicles T&E, which means the remaining excess capacity cannot be reduced through further realignments/consolidations. Although the total DoD workload for OAR Air Vehicles T&E could be further consolidated into a single site, it would require operating at approximately 189% of the demonstrated maximum capacity (achieved during the 1986-1993 timeframe) for either site. In addition to not satisfying the total DoD T&E capability requirements (i.e. cannot satisfy both maritime/carrier suitability requirements and large overland requirements at one site) and Policy Imperative 3a (i.e. diverse climatology and topography), this option was assessed as having unacceptable risk for the DoD.

Similarly, the two best sites to accommodate the projected DoD workload for Air Armaments/Weapons OAR T&E are AFDTC (Eglin) and WSMR (White Sands). Again, with the addition of a few specialty sites, this combination satisfies all DoD requirements (capability and workload/capacity) and all T&E JCSG policy imperatives (see Annex 2 for details). It too represents the minimum achievable T&E infrastructure and excess capacity for DoD Air Armaments/Weapons T&E with acceptable risks. This alternative allows for the retention of ground facilities at NAWC (China Lake) to support Navy weapons R&D and life-cycle support for sea-launched and Navy unique systems.

For Electronic Combat T&E, the two best sites to accomplish the projected DoD workload for OARs are AFDTC (Eglin) and the Nellis Range Complex (an EC T&E capability that the T&E JCSG agreed would be filled to capacity before any other EC OAR). Combined with the consolidation of EC ground facility capabilities at the two principal Air Vehicle T&E sites (Edwards and Pax River) and specialty sites, this consolidation satisfies all DoD requirements and policy imperatives (see Annex 1 for details). It also represents the minimum achievable T&E infrastructure and excess capacity for DoD EC T&E with acceptable risks. By integrating EC ground facilities into the avionics ground facilities at the principal AV sites, this provides a more effective means to test integrated avionics/EC systems in future aircraft.

Capabilities required to support AV, A/W, and EC T&E, but which are geographically constrained or not cost effective to collocate at a MRTFB OAR, are retained at the specialty sites shown. These T&E capabilities/facilities include wind tunnels, propulsion, inertial guidance, radar cross-section measurements, high-speed sled track, and critical air/land space for cruise missile testing.

Although these alternatives are technically viable and satisfy all requirements, the next step is to conduct a cost analysis to determine if they are economically feasible. This is shown in charts 88-92 after comparison of the analysis results here with the T&E JCSG Co-Chair alternatives for "core" T&E activities.

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# T&E JCSG Co-Chair Alternatives

**(22 Nov 94 Transmittal Memo)**

- Co-Chair Alternatives Address Either/Or Options Which Include Realignment of All T&E (AV, A/W, & EC) Between "Core" Activities
  - AFFTC (Edwards) vs NAWC (Pax River)
  - AFDTC (Eglin) vs NAWC (China Lake)
  - NAWC (Pt Mugu) to NAWC (China Lake) or AFDTC (Eglin)
  - Army Rotary Wing T&E (Ft Rucker & AQTD/Edwards) to AFFTC (Edwards) or NAWC (Pax River)
    - Only If Fixed Wing AV T&E Consolidated at One Site

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The T&E JCSG Co-Chair alternatives were provided in their 22 Nov 94 memorandum (Ref 2). These alternatives were proposed to address excess capacity among "core" T&E activities, but no analysis was provided to justify how they were developed.

The entire T&E JCSG analysis process was set up to analyze certified data, using measures of merit approved by the T&E JCSG and BRAC Steering Group, to develop alternatives, based on this analysis, for consideration by the MILDEPs in their BRAC installation analysis. Not only were the T&E JCSG alternatives not supported by analysis, they represent options versus specific alternatives derived through analysis.

In addition, the T&E JCSG Co-Chairs imposed other considerations, not supported by analysis or data, that rotary-wing T&E should only be considered for realignment/consolidation if fixed-wing AV T&E is consolidated at one site. As has been shown in the previous analysis, it is not possible to consolidate all fixed-wing T&E at one site, based on the projected workload, but it is possible to consolidate rotary-wing T&E into the two AV sites.



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# T&E JCSG Co-Chair Alternatives

## Assessment

| Primary T&E Areas | Control Number | Proposed Realignment Alternative | Supported by Analysis | * Alternative Based on Analysis |
|---|---|---|---|---|
| AV<br><br>(Rotary Wing) | T&E-1<br>T&E-4<br>T&E-7** | NAWC (Pax) to AFFTC (Edwards)<br>AFFTC (Edwards) to NAWC (Pax)<br>ATTC (Ft Rucker)/AQTD (Edwards) to AFFTC (Edwards) or NAWC (Pax) | No<br>No<br>Yes | • Realign to AFFTC (Edwards) and NAWC (Pax) |
| AW & EC | T&E-2<br>T&E-3<br>T&E-6<br>T&E-5 | AFDTC (Eglin) to NAWC (CL)<br>NAWC (CL) to AFDTC (Eglin)<br>NAWC (Pt Mugu) to AFDTC (Eglin)<br>NAWC (Pt Mugu) to NAWC (CL) | No<br>Yes<br>Yes<br>No | • Realign NAWC (CL) and NAWC (PM) A/W into AFDTC (Eglin)<br>• Realign NAWC (CL) EC OAR to Nellis Complex and AFDTC (Eglin) |

* Based on Completion of T&E JCSG Analysis Plan
** Only if Fixed Wing AV T&E Consolidated at One Site

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Comparing the T&E JCSG Co-Chair alternatives with the results from the analysis of "core" T&E activities, based on completion of the T&E JCSG analysis plan using certified data, only 3 of the 7 alternatives are supported by analysis.

The realignment of all fixed-wing AV T&E into one site, either Pax River or Edwards, is not supported by the analysis of the certified data. Rather, both sites are required to handle the projected workload, along with a few specialty sites, and to satisfy the DoD T&E requirements and T&E JCSG policy imperatives. Also, excluding rotary-wing T&E from consideration is not consistent with the analysis results since rotary-wing T&E could be absorbed into these two fixed-wing sites.

Similarly, only the realignment of NAWC (China Lake) and NAWC (Pt Mugu) into AFDTC (Eglin) are supported by analysis for Armaments/Weapons. Both sites are likewise required to handle the projected workload, along with a few specialty sites, and to satisfy DoD T&E requirements and T&E JCSG policy imperatives.

For Electronic Combat OAR T&E, only the realignment of NAWC (China Lake) into the Nellis Complex and AFDTC (Eglin) is supported by analysis. The remaining EC T&E ground facilities from China Lake, and those from Pt. Mugu would be realigned into AFDTC (Holloman) for RCS measurements, AFDTC (Eglin) for signature measurement, and NAWC (Pax River) for EC HITL (to provide HITL/ISTF EC capability against sea threats). Other EC ground facilities (REDCAP and AFEWES) were covered by the T&E JCSG alternatives for "Non-core" T&E activities.

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## T&E Cost Analysis
### Assumptions

- ROUGH ORDER OF MAGNITUDE (ROM) COST ESTIMATE BASED ON
  - CERTIFIED DATA (E.G., T&E FACILITIES, MANPOWER, EQUIPMENT)
  - EXPERT JUDGEMENT FOR REMAINDER
  - I&M, MAINTENANCE YEARLY AVERAGE FOR CONTINUING COST OF OPERATION
- COBRA USED FOR ANALYSIS
- CONCEPT OF OPERATIONS:
  - AW/AV OAR - OPERATE AS DET
  - EC OAR/MF - ASSIMILATE INTO CURRENT OPS

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This chart provides the assumptions used to accomplish the COBRA Rough Order of Magnitude (ROM) cost analysis. Certified data were used in all cases where it was available to meet the option criteria. These certified data were acquired from either the JCSG inputs or BRAC certified inputs. There were areas not covered by either BRAC or JCSG data inputs that required analysis of the requirement by functional experts and/or the use of expert knowledge to provide the inputs.

A ROM analysis is being used since all the data required to complete a thorough COBRA analysis exceed that provided by the various BRAC data calls. Expert judgment was used to define the key data elements required to provide a reasonable analysis of all the various options. COBRA was not designed to be used as a budgeting tool. The use of limited data, while changing the total cost figures, will not change the prevailing outcome of cost effectiveness associated with the option. Care was taken to identify those areas (i.e. personnel and continuing costs/savings) that are the prevalent factors relating to long-term cost effectiveness.

When possible, yearly operating costs were developed to provide continuing costs/savings of the option. Primarily, the maintenance and I&M costs identified in the JCSG input were used as continuing costs of operation. In some cases, O&M contractor numbers were known and an average for east and west coast salaries were used to develop continuing costs of operation.

COBRA was used for all cost evaluations. COBRA uses standard factor tables for data that are independent of specific installations for personnel, transportation, facility and construction factors. Within COBRA, Screen 4 is used for base installation peculiar factors or base specific demographics. All Air Force Screen 4's were provided by AF/RT.

If other service Screen 4 data were unavailable or could not be constructed, the Air Force counterpart was used for the evaluation.

A concept of operations was developed prior to using the COBRA for analysis. These concepts varied dependent on resultant operations developed by functional area experts. EC was assimilated into current operations since most equipment and facilities were in place to accommodate the workload. AW/AV were operated as a Det since service peculiar aircraft are involved and test conduct would be better accomplished by the owner/operator of the aircraft/requirement.

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## T&E Cost Analysis
### Scenarios

- Electronic Combat (EC):
  - OAR - Core-1 (EC): Move China Lake EC Range Sea threat assets to Eglin (Aircraft not included).
  - MF - Core-2 (EC): Move China Lake Junction Ranch workload to Holloman.
- Armament/Weapons (A/W):
  - OAR - Core-1 (AW): Move all China Lake and Pt Mugu OAR to Eglin to include aircraft from both bases. (includes Core-1 (EC))
    - Yuma OAR not included since aircraft for AW and AV not identified and AW workload predominantly surface-to-surface plus other activities.
- Air Vehicles (AV):
  - OAR - Core-1 (AV): Move rotary wing T&E from Ft Rucker to Edwards
    - Yuma AV OAR not included for same reason as above

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**EC:**

For the OAR, assets were moved to Eglin to be incorporated into the current range operation. No personnel would be required to accommodate the new operations except for additional O&M range contractors to operate the equipment.

For MF, no assets are required since the Holloman operation has a greater capability than Junction Ranch. Workload would be transferred and could be accommodated into the current operation without the addition of personnel.

**AW:**

OAR moves all aircraft and sufficient personnel to conduct test management. Range operations and all other ancillary test operations can be accommodated within current capacity and would be conducted with the current work force. Yuma was not included in the evaluation since savings appeared to be limited due to all the other service peculiar operations that would still be required at Yuma.

**AV:**

Rotary Wing was moved from Ft Rucker to Edwards. The Army currently maintains a test force and aircraft at Edwards and this operation could probably be combined with the Rotary wing test requirement. Personnel and equipment savings would be realized from this consolidation, but insufficient time and information were available to identify the proper areas and factor any of these savings into the analysis. Additionally, Edwards can probably accommodate some of the shop support requirements of the Rotary Wing operation into their current capacity without additional personnel resulting in additional personnel savings for this option.

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# T&E Cost Analysis
## Summary

| | 1-Time Cost ($M) | 20 YR NPV* ($M) | Steady State Savings ($M) | ROI (Yrs) | Govt Pers Savings |
|---|---|---|---|---|---|
| Electronic Combat (EC) | | | | | |
| OAR Core-1 (EC) | 7.4 | (129.8) | 11.0 | 0 | 108 |
| MF Core-2 (EC) | 0.3 | (13.7) | 0.9 | 0 | 16 |
| Armament/Weapons (A/W) | | | | | |
| OAR - Core-1 (A/W) (INCLUDES Core-1 (EC)) | 50.3 | (2315.8) | 178.1 | 0 | 1494 ** |
| Air Vehicles (AV) | | | | | |
| OAR - Core-1 (AV) | 2.6 | 18.3 | (1.7) | NEVER | 0*** |

* ( ) Indicate Savings
** Requires End Strength Adj of 53 Mil & 32 Civ + $4.1M/Yr TOA for BOS
*** Requires End Strength Adj of 5 Mil & 4 Civ + $0.6M/Yr TOA for BOS

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**EC:**

OAR **Core-1 (EC):** This option reflects the transfer of the Navy sea-threat simulators from the ECR at China Lake to the EMTE at Eglin. **$7.4M** 1-Time Cost primarily reflects the cost of shipping threat assets and constructing concrete pads for the transferred systems. The **($129.8M)** 20 year savings is composed primarily of salary savings that are also the primary factor in the **$11.0M** per year steady state savings. This is a result of the government personnel savings of **108**. The savings are immediate, resulting in an ROI of **0** years. Non-transferred systems are mothballed.

**MF Core-2 (EC)**: This option transfers the China Lake Junction Ranch Measurement Facility workload to RATSCAT/RAMS at Holloman. No equipment or personnel are transferred. Capacity is sufficient at Holloman to accommodate the additional workload without additional personnel. The 1-Time Cost of **$0.3M** primarily reflects elimination costs of the government personnel savings of **16** people. The personnel elimination results in a **0** year ROI as well as a yearly savings of **$0.9M** that provides a 20 year NPV of **($13.7M)**.

**AW:**

**OAR Core-1 (AW)**: This option includes both the EC and AW Open Air Range (OAR) capabilities associated with Point Mugu and China Lake. Both functions were moved to and consolidated with Eglin. All aircraft operations were transferred from both bases on this option. Range and support personnel were eliminated and a cadre of test management personnel was transferred to operate as a Detachment based at Eglin. The government personnel savings of **1494** was the overriding factor in the yearly steady state savings of **$178.1M** and the resultant 20 year NPV of **($2,315.7M)**.

The 1-Time Cost of **$50.3M** primarily includes costs for equipment transfer and facility rehab. Since this inter-service move includes a significant personnel transfer, it will require an end-strength transfer as well as TOA transfer to accommodate the increased BOS requirement.

**All - Core-2 (AW)**: No cost estimates were done on this area since the magnitude of the numbers of facilities requires a cooperative effort involving all service functionals to define specific workload to be transferred as well as defining facilities and capabilities that are common.

**AV:**

**OAR Core-1 (AV)**: Transfers Rotary Wing testing from Ft Rucker to Edwards. This option does not include any cost savings from personnel efficiencies associated with the consolidation of the Rotary Wing test with current Army test operations at Edwards. The option also does not include personnel savings that would result from Edwards assimilating some of the Rotary Wing shop support requirements. This **0** government personnel savings and the lack of any other salary savings results in yearly steady state costs vice savings of **$1.7M** that results in a 20 year NPV of **$18.3** and no return on initial cost or investment. The 1-Time Cost of **$2.6M** is primarily from shipment of equipment and termination of BOS/RPMA personnel at Ft Rucker. This inter-service option includes a personnel transfer and it would require an end-strength transfer as well as TOA transfer to accommodate increased BOS support required as a result of the move.

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## Part II: Summary

- Only Parts of T&E JCSG Co-Chair Alternatives Supported by Analysis of T&E JCSG Data
  - In All Cases, AF Preferred Receiver Site
- Significant Reductions in Excess Capacity Possible Through Implementation of T&E JCSG Alternatives for "Non-Core" Activities
  - Combined with Intra-Service Realignment Opportunities, Significantly More Reductions possible
- Significant Cost/Savings Possible By Implementing Alternatives for "Core" T&E Activities, as well as Further Reductions in Excess Capacity
  - OAR Alternatives Provide Greatest potential for Savings
  - Ground Facility Alternatives Offer Decreasing Potential for Savings, and Greatest impact on Other Mission Areas (e.g., S&T, R&D, ISE, etc.)

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Based on analysis of the T&E JCSG certified data, in accordance with the approved T&E JCSG analysis plan, only 3 of the 7 T&E JCSG Co-Chair alternatives for "core" T&E Activities are supportable. In all cases, the T&E JCSG approved optimization model runs selected Air Force sites as the preferred receiver site. This outcome is as expected since the principal AF T&E activities scored the highest Functional Values in each functional area (i.e., AV, A/W, and EC)

Although significant reductions in excess capacity are possible through implementation of the T&E JCSG alternatives by the MILDEPs for "non-core" T&E activities, even more significant reductions are possible through intra-service realignments/consolidations by each MILDEP. If the T&E JCSG alternatives help to close a "non-core" T&E activity, significant cost savings might also be realized.

In addition, significant savings are possible by implementing some of the alternatives for "core" T&E activities. Although further reductions in excess capacity are not as large, the costs/savings associated with OAR realignments can be quite significant. On the other hand, ground facilities offer less potential for savings and tend to create a greater impact on other mission areas because of their multiple use.